

FLORA OF PANAMA

Part V. Fascicle 1

LAURACEAE

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Evergreen trees or shrubs in the Panamanian species, rarely herbs (*Cassytha*); leaves alternate, occasionally subverticillate, rarely opposite, entire, pinninerved, triplinerved or subtriplinerved, rarely subquintuplinerved. Inflorescence axillary or subterminal, usually paniculate. Flowers usually perfect, rarely dioecious, perianth 6-lobed, fertile stamens usually 9, in series of three; anthers erect, 2- or 4-celled, those of the two outer series usually introrse, those of the inner extrorse or occasionally the third of the inner series only fertile; filaments of the inner series always biglandular; staminodia, representing a fourth series, may be present or absent. Ovary superior, 1-celled, bearing a style, usually well developed, and a variable stigma. Fruit a 1-seeded berry, subtended by a disk or cupule formed by the enlarged perianth-tube, sometimes crowned by the remnants of the perianth-lobes, and supported by the usually enlarged pedicel.

About 50 genera throughout the world, one of the heaviest areas of concentration being in the Malaysian region and Eastern Asia, the second focus being in tropical America. A few genera only are to be found in Africa and one in Europe. Of those genera occurring in Central and South America, three are also abundant in Eastern Asia and Malaysia, namely, *Beilschmiedia*, *Cryptocarya* and *Phoebe*. More rare for the Lauraceae is the distribution noted in the genera *Lindera* and *Sassafras*, where a single rather widespread species of each occurs in the United States, the remaining species of *Sassafras* occurring in Eastern Asia, and of *Lindera* in Eastern Asia and Malaysia. *Litsea* and *Persea* occur in the United States, along the Atlantic Coast, and from upper Mexico into South America.

The following is based on the publication by the author, 'Studies in the Lauraceae, VI, Preliminary Survey of the Mexican and Central American Species' (Jour. Arnold Arb. 26:280-434. 1945), where a more complete synonymy is available. In the present treatment of the family fairly broad descriptions of the genera are given unless otherwise indicated. Data on the commercial uses of the woods are obtained from field notes and in some cases from 'Timbers of the New World,' by Record & Hess.

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- a. Anthers 4-celled.
 - b. Staminodia large, cordate, stipitate.
 - c. Perianth-lobes usually unequal or at most subequal; usually the lower cells of the anther touching the upper at their sides..... 1. PERSEA
 - cc. Perianth-lobes equal or subequal; usually lower cells of the anther touching the upper at their bases..... 2. PHOEBE
 - bb. Staminodia small, inconspicuous or occasionally lacking.
 - c. Flowers perfect or dioecious; perianth-lobes not reflexed at anthesis, thin in texture; cells of the anthers arranged in two planes, one above the other..... 3. OCOTEA
 - cc. Flowers always perfect; perianth-lobes usually fleshy, papillose and reflexed at anthesis; cells of the anthers arranged in an arc..... 4. NECTANDRA
- aa. Anthers 2-celled.
 - b. Flowers perfect.
 - c. Flowers with 9 fertile stamens; fruit subtended by cupule with single margin or subtended by a naked pedicel.
 - d. Staminodia well developed; fruit subtended by naked pedicel.... 5. BEILSCHMIEDIA
 - dd. Staminodia absent; fruit subtended by dentate cupule..... 6. AIOUEA
 - cc. Flowers with 3 fertile stamens; fruits subtended by cupules with double or triple margins..... 8. LICARIA
 - bb. Flowers dioecious..... 7. ENDLICHERIA

The genus *Cassytha* probably is represented in Panama by *C. filiformis* L. which is found in the tropics of the entire world, but is not common in Central America. The plants are parasitic herbs, similar in habit and general appearance to *Cuscuta*, but the floral structure is typically lauraceous.

Exotic LAURACEAE cultivated in Panama include *Cinnamomum Camphora* (L.) Nees & Eberm., the source of commercial camphor (*Alcanfor*), and *C. zeylanicum* Nees, cinnamon (*Canela*).

1. PERSEA Miller

PERSEA Miller, Gard. Dict. ed. 8. 1768.

Evergreen trees (in Panama). Leaves alternate or subverticillate, the blades pinninerved. Inflorescence usually of numerous axillary or subterminal panicles, frequently subsessile (in Panama), pubescent, with persistent or deciduous bracts, often many-flowered. Flowers perfect, usually fairly conspicuous, sessile or pedunculate. Perianth-tube none, or so shallow as to appear lacking. Perianth-lobes often spreading, frequently conspicuously unequal, pubescent, usually persistent. Stamens of all three series fertile (in Panama), with pubescent filaments; anthers 4-celled (in Panama), the cells in 2 planes, the bases of the 2 upper cells laterally tangential to the apices of the 2 lower cells; cells of the two outer series introrse, the filaments long and sometimes pubescent; those of the inner series extrorse or the 2 upper cells may be lateral and the 2 lower extrorse, with the filaments distinctly biglandular. Staminodia usually large, conspicuous, subcordate and pubescent, with the stipes of varying length, or occasionally ligulate. Ovary subglobose or ovoid, pubescent or glabrous, sometimes constricted at the base or slightly stipitate. Style usually filiform, usually longer than the ovary, and occasionally pubescent. Stigma inconspicuous, discoid or conspicuous and triangularly peltate. Fruit small, globose or large, fleshy, pear-shaped, edible, usually glabrous, entirely or almost entirely exserted at maturity, and subtended by persistent or occasionally deciduous perianth-lobes.

The genus consists of approximately 145 species. The largest number is native to South America (70), with the heaviest concentration in Brazil. Twenty-two species occur in Mexico and Central America. Of these, five at the most are common to both regions. Thirteen are to be found in the West Indies and eight in the United States. Twenty Asiatic species are known with ten from Malaysia and one each from Australia and the Mascarenes. Two species are reported from the Azores and Canary Islands, but these perhaps should not be included in the genus. Except for the Avocado, the genus is unimportant commercially.

- a. Leaf-blades coriaceous, 10–30 × (3–) 10–15 (–20) cm., elliptic, irregularly or obovate-elliptic, ovate, or obovate.
- b. Blades irregularly or obovate-elliptic, ovate or obovate, coriaceous, 15 (–20) cm. broad, pubescent to glabrous or glaucous beneath; petioles 1.5–5 cm. long; panicles usually numerous in axils of persistent upper leaves; ovary pubescent; large edible fruit.
- c. Branchlets yellow-tomentellous becoming glabrous or subglabrous; blades variable, usually elliptic, lower surface subglaucous, usually up to 20 cm. broad, acuminate; floral bracts deciduous; fruit variable..... 1. *P. AMERICANA*
- cc. Branchlets and lower surface of leaf-blades densely brown-tomentose; blades 10–15 cm. broad, obtuse or abruptly acuminate; floral bracts persistent; fruit obovoid..... 2. *P. SCHIEDEANA*
- bb. Blades always elliptic, rigidly coriaceous, usually not more than 7–8 cm. broad, occasionally 12 cm., glabrous; petioles not more than 1.5 cm. long; numerous panicles in axils of deciduous upper leaves; ovary glabrous..... 3. *P. RIGENS*
- aa. Leaf-blades parchmentaceous or chartaceous, up to 17 × 7.5 cm., always elliptic.
 - b. Outer perianth-lobes small and scale-like, approximately one-fourth the length of the inner; fruit shining, 7 mm. in diameter..... 4. *P. SKUTCHII*
 - bb. Outer perianth-lobes more than one-half the length of the inner; fruit with bluish bloom, 10–11 cm. in diameter..... 5. *P. VERAGUASENSIS*

1. *PERSEA AMERICANA* Miller, Gard. Dict. ed. 8. 1768.

Tree to 20 m. high; branches light gray, fissured. Leaves crowded at branchlet tips; petioles yellow or yellow-green, pubescent to glabrous, 1.5–5 cm. long; blades pubescent to glabrous, dark green, somewhat shining above, glaucous below, coriaceous, ovate or obovate-oblong, 10–30 cm. long and 3–20 cm. broad, the base cuneate or obtuse, the apex acute or obtuse or obtusely acuminate, the lateral nerves up to 10 pairs, elevated beneath, the venation yellow. Inflorescence of axillary subterminal panicles, densely pubescent, many-flowered, with deciduous bracts. Flowers small (6–7 mm. long, 0.5–1.5 mm. in diameter), fragrant, tomentose, with yellow-green pedicels up to 5 mm. long; perianth yellow-green or light yellow, the lobes unequal, the outer 3 mm. long, the inner 6 mm. long, persistent; stamens of ser. I & II 2.5–3.5 mm. long, those of ser. III longer, with extrorse anthers; staminodia short-stippled; gynoecium 4–5.5 mm. long, the ovary pubescent, the stigma discoid. Fruit large, pear-shaped, globose, or oval, 7–20 × 7–10 cm., the pulp fleshy, thick, juicy, oily, the seed large, 2.5–5 cm. in diameter, globose.

Native probably of Mexico and Central America, and possibly the West Indies; for centuries widely cultivated for its edible fruit throughout these regions and all tropical and subtropical countries. Known as *Aguacate*, *Avocado* and "Alli-

gator Pear." Seeds yield proprietary oil. Wood medium to coarse in texture, easily worked but not durable and therefore commercially unimportant.

2. *PERSEA SCHIEDEANA* Nees, Syst. Laurin. 130. 1836.

Tree (or shrub) 20–50 m. high; branchlets brown-tomentose becoming glabrescent; petioles up to 3 cm. long; blades shining above, glaucous and brown-tomentose beneath, irregularly elliptic, often obovate-elliptic, 24–30 cm. long and up to 15 cm. broad, the base usually rounded, frequently almost truncate, the apex rounded, acute or abruptly acuminate or obtuse, lateral nerves 8–10 pairs, the



Fig. 1. *Persea Schiedeana*¹

lowermost diverging from the costa at an angle of 75–80°, the upper 35–40°, loosely reticulate. Inflorescence of numerous subterminal subsessile panicles 10–15 cm. long, with persistent bracts. Flowers 6–8 mm. long, borne on slender pedicels usually of equal length; perianth pale greenish yellow, turning crimson at the base or light rose with age, the lobes subequal, to 7 mm. long, persistent, pubescent without, stamens to 3.8 mm. long, the filaments twice the length of the anthers, the two upper cells often only one-half the size of the two lower; those of ser. III with conspicuous, cordate, stipitate glands; staminodia to 2.5 mm. long, cordate,

¹In this and the following Lauraceae illustrations the habit sketches (a) are approx. $\times \frac{2}{3}$; flower (b), approx $\times 3$; outer and inner perianth-lobes (c and d), approx. $\times 7$; stamen (ser. I & II, e, and ser. III, f), \times approx. 13; staminodium (g), \times approx. 13; gynoecium (h), \times approx. 13. Habit sketches drawn by Mrs. Martha Suttis Koteles.

stipitate, the pubescent stipe one-half the entire length; gynaecium ± 3.8 mm. long, the ovoid ovary pubescent, the slender style pubescent, twice the length of the ovary, the stigma inconspicuous. Fruit similar to that of *P. americana*, obovoid, early very pubescent, later becoming glabrescent and roughened, subtended by thickened, persistent perianth-lobes which are borne on enlarged pedicels, both lobes and pedicels becoming glabrescent.

Native of Mexico and Central America; cultivated particularly in Guatemala for its edible fruit. Utilized to a limited extent locally for interior construction, but is not resistant to insects and hence is of little economic value. Native name *Aguacatón*; known commercially as "Guatemala Avocado."

CHIRIQUÍ: vicinity of Cerro Punta, *Allen* 1534; Bajo Chorro, Boquete, *Davidson* 304, 427, *Pittier* 3132. PANAMÁ: Isla Taboga, *Allen* 1288.



Fig. 2. *Persea rigens*

3. *PERSEA RIGENS* C. K. Allen in Jour. Arnold Arb. 26:297, 432. 1945.

Tree to 30 m. high; branchlets stout, glabrous, brown or maculate-brown. Leaves alternate or subverticillate; petioles brown, glabrous, thick, scarcely canaliculate, up to 1.5 cm. long; blades glabrous, castaneous or olive-green, membranaceous becoming rigidly coriaceous, elliptic, (12-) 20-25 (-35) cm. long and 7 (-12) cm. broad, the base cuneate, the apex obtuse or obtusely subacute, the lateral nerves 7-9 pairs, diverging arcuately at an angle of 45-55° from the costa, the venation conspicuous, conspicuously elevated beneath, the minute

reticulation prominent. Inflorescence of numerous panicles in axils of deciduous upper leaves, densely greenish-fulvous-whitish-pubescent, up to 10 cm. long, the peduncle 6 cm. long. Flowers tomentose, to 4 mm. long, with pedicels of equal length; perianth campanulate, the subequal lobes thick, up to 3 mm. long; stamens of ser. I & II often subpetaloid, up to 2.15 mm. long, those of ser. III with stiped glands; staminodia to 1.7 mm. long, subcordate, stipitate; gynoecium glabrous, to 2.8 mm. long, the ovary ovoid or subglobose, equal to or twice the length of the somewhat robust style, the stigma subtriangular, conspicuous. Fruit unknown, the subtending pedicel thickened and rough, up to 7 mm. long, bearing the expanded remnants of the perianth-lobes.

Native of Panama. Known as "Timber Sweetwood," *Pizarrá*. Wood used for boards and rough lumber.

BOCAS DEL TORO: Daytona Farm, region of Almirante, *Cooper 458* (Y12076). CHIRIQUÍ: near sawmill on Río Chiriquí Viejo, 3 km. n. of Camp El Volcán, *Little 6057, 6058, 6075*.

Easily distinguished by the dense many-panicked inflorescences heavily grayish- or fulvous-white-tomentose.



Fig. 3. *Persea Skutchii*.

4. **PERSEA SKUTCHII** C. K. Allen in Jour. Arnold Arb. 26:298. 1945.

Spreading tree to 25 m. high; branchlets reddish, striate, pale appressed-feruginous-tomentose becoming glabrous. Leaves alternate or subverticillate; petioles brown, slender, scarcely canaliculate, up to 3.5 cm. long; blades glabrous and pale green above, sparsely pubescent and pale brown or glabrous beneath, perpenden-

ceous, elliptic, 10–14 (–17) cm. long and 5 (–7.5) cm. broad, the base rounded or cuneate, often oblique, the apex obtuse, acute, or acuminate, often emarginate, the margin undulate, the lateral nerves up to 12 pairs, diverging from the costa at an angle of 55 (–65°). Inflorescence of loose, axillary, fulvous-sericeous panicles up to 12 cm. long. Flowers to 6 mm. long, with slender pubescent pedicels nearly as long; perianth campanulate, pale yellow, lobes unequal, the outer 1.5 mm. long, the inner 5 mm. long; stamens of ser. I & II to 3.36 mm. long, the filaments almost twice the length of the anthers, the stamens of ser. III slightly longer, with stipitate glands; staminodia conspicuous, pubescent, subcordate, to 2.7 mm. long, stipitate; gynoecium glabrous, 3.42 mm. long, the ovary ovoid, slightly constricted at the base, shorter than the style, the stigma conspicuously triangular-peltate. Fruit black, shining, glabrous, globose, inconspicuously apiculate, about 7 mm. in diameter, the pedicel sparsely pubescent, somewhat thickened at the apex to nearly 2 mm. in diameter, and crowned with the remnants of the more or less reflexed perianth-lobes measuring about 6 mm. in diameter.

Native to Costa Rica and Panama from 300 to 1675 meters altitude.

COCLÉ: vicinity of El Valle, south rim (dry), *Allen 1781*; hills south of El Valle de Antón, *Allen 2498*.

Near *Persea caerulea* from South America, but may be distinguished by inflorescences that are shorter than the leaves, which are acute or subacuminate, with less erect lateral nerves, and by the blackish depressed-globose fruits not more than 8 mm. in diameter, with no conspicuous bloom.

5. PERSEA VERAGUASENSIS Seemann, Bot. Voy. Herald, 193. 1854.

Tree from 3–18 (–25) m. high; branchlets densely striate, angled, densely subferruginous-sericeous becoming glabrescent and atro-rubescens or gray-brown-maculate. Leaves alternate; petioles slender to robust, rusty-pubescent to glabrescent, 2.5–3 cm. long; blades dark green, shining above, glabrescent and pale or glaucescent beneath, and sericeous-pubescent, chartaceous, oblong-elliptic or elliptic, 8–17 cm. long and up to 6 cm. broad, the base obtuse or cuneate, sometimes subrhomboid, the apex acute, acuminate or obtuse, the lateral nerves 8–10 pairs, conspicuous beneath, diverging from the costa at an angle of 35–45°. Inflorescence axillary, of few-flowered, ferruginous- or buff-sericeous-tomentose panicles shorter than the leaves, up to 6 cm. long, the peduncle sericeous. Flowers to 4 mm. long, sessile or with sericeous pedicels up to 1 mm. long; perianth-lobes fleshy, unequal, the outer 1.3–2.5 mm. long, the inner 2.5–4.5 mm. long; stamens 2.15–2.6 mm. or more long (ser. II & III longer); staminodia to 1.7 mm. long, ligulate, pubescent; gynoecium 3.42 mm. long, the ovary glabrous, ovoid, slightly stipitate, the style pubescent, the stigma triangular-discoid. Fruit globose, apiculate with bluish bloom, 10–11 mm. in diameter, subtended by the enlarged perianth-lobes and seated on the enlarged red pedicel.

Woods of Costa Rica south into Panama from an altitude of 600 to 2300 meters. Described by Seemann from Volcán de Chiriquí.

Fig. 4. *Persea veraguasensis*

CHIRIQUÍ: Bajo Mona, Boquete, *Davidson* 516; savannas of Boquete, *Davidson* 753; Río Chiriquí Viejo Valley near El Volcán, *P. White* 213; in the open llanos about a mile from Bambito, valley of the upper Río Chiriquí Viejo, *P. White* 334.

Also similar to *Persea caerulea* from South America, but easily separated by the few-flowered panicles shorter than the leaves, the shorter leaf-blades with nerves, and petioles that are not reddish in color.

2. PHOEBE Nees

PHOEBE Nees, Syst. Laurin. 98. 1836.

Evergreen trees or shrubs. Leaves alternate, the blades triplinerved or subtriplinerved, occasionally penninerved. Inflorescence paniculate, axillary and usually subterminal; panicles loose or narrow, strict, somewhat racemose, with no involucre. Flowers perfect, pedicellate or occasionally sessile. Perianth-tube short although usually well-defined. Perianth-lobes approximately equal or subequal, occasionally the three outer lobes shorter, usually incurved, rarely reflexed, and, for the most part in Panama, thin in texture. Stamens of all three series with four fertile anther-cells; anther-cells of the two outer series introrse, the two upper cells slightly smaller than the two lower, frequently with inconspicuous connective tissue; two lower anther-cells of inner series extrorse, the two upper usually slightly smaller, lateral or at most laterally extrorse; filaments of inner series conspicuously biglandular. Staminodia well developed, conspicuous, cordate, stipitate,

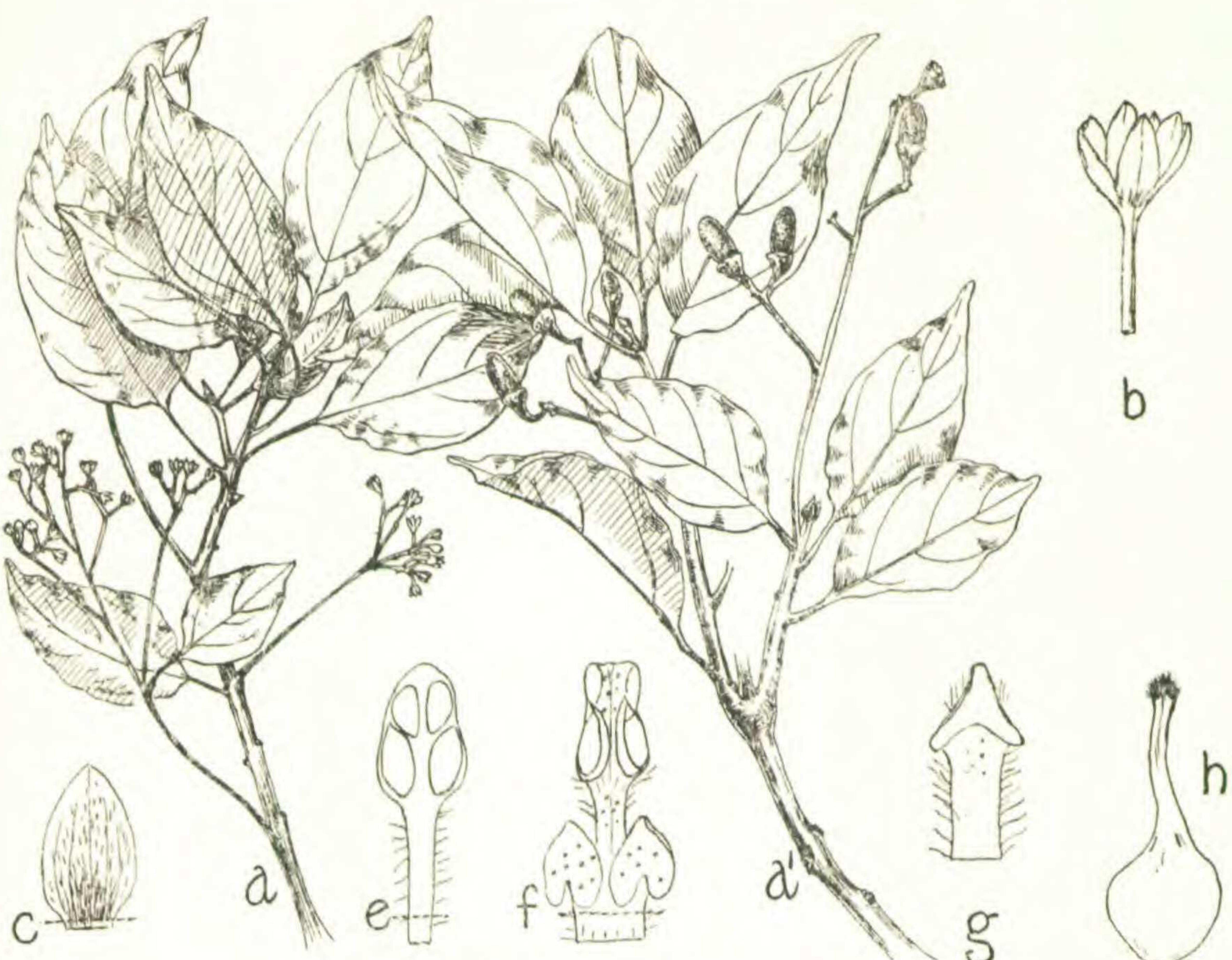
the stipe usually pubescent. Ovary glabrous, usually ellipsoid, occasionally sub-globose. Style cylindrical, slender, equal to or shorter than the ovary, glabrous. Stigma usually triangularly discoid or capitate, fairly conspicuous. Fruit a berry, borne in a shallow somewhat fleshy cupule frequently crowned by the remnants of the perianth-lobes, and subtended by the enlarged pedicel.

The genus consists of approximately 120 recognized species, about 80 of which are in this hemisphere. Of this number one-half occur in Mexico and Central America, the bulk of the remainder in South America with about a half-dozen in the West Indies. In the eastern hemisphere the species are to be found about equally divided between Malaysia and the mainland of Asia. Only one species from Brazil is important commercially, being used for interior construction and furniture.

- a. Leaf-blades triplinerved or subtriplinerved.
 - b. Blades not more than 10 cm. long..... 1. *P. BRENESII*
 - bb. Blades usually not less than 12 cm. long.
 - c. Blades definitely triplinerved, coriaceous; nervation not pale reddish; panicles 10-19 cm. long.
 - d. Blades narrowly elliptic; inflorescences loose, spreading, few-flowered panicles..... 2. *P. COSTARICANA*
 - dd. Blades elliptic to lanceolate or oblong-elliptic; inflorescences numerous, narrowly racemose, many-flowered panicles..... 3. *P. MEXICANA*
 - cc. Blades subtriplinerved, membranaceous becoming pergamentaceous; nervation pale reddish; panicles not more than 12 cm. long..... 4. *P. JOHNSTONII*
 - aa. Leaf-blades pinninerved..... 5. *P. PITTIERI*

1. *PHOEBE BRENESII* Standley in Field Mus. Publ. Bot. 18:459. 1937.

Small tree 5-6 (occasionally 4-22) m. high; branchlets slender, early fulvous-tomentellous becoming glabrescent, striate and even angled. Leaves alternate or subopposite occasionally; petioles slender, pubescent becoming glabrous, canaliculate, up to 2 cm. long; blades early glabrous above except for remnant of pubescence on venation, glabrescent beneath except for axillary glands, membranaceous becoming coriaceous, elliptic or oblong-elliptic, rarely broadly elliptic, 3.5-7 (-10) cm. long, 2-3.5 (-4.5) cm. broad, the base cuneate, the apex abruptly acuminate or caudate-acuminate, triplinerved, the slender lowermost pair of nerves less obscure than the 2 or 3 upper pairs, and diverging from the costa at about 0.5-1 cm. above the base. Inflorescence axillary and subterminal, loosely paniculate, glabrous or glabrescent, up to 12 cm., usually shorter than the leaves, the slender peduncles glabrous, up to 7 cm. long. Flowers 3.4 mm. long, glabrous, the pedicels of equal length; perianth-lobes 2.5 mm. long, ovate, thin, pubescent within; stamens of ser. I & II 1.7 (-2.15) mm. long, frequently somewhat emarginate, the oblong anthers usually equaling or sometimes nearly twice the length of the slender pubescent filaments, the stamens of ser. III 2.15 mm. long, the more narrow anthers equalling the biglandular filaments, glands conspicuous, cordate, stipitate; staminodia cordate, stipitate, 1.4 mm. long, the pubescent stipe broad, more than one-half the entire length; gynoecium glabrous, 2.4 mm. long, the ovary subglobose, shorter than the slender style, the stigma triangularly discoid.

Fig. 5. *Phoebe Brenesiae*

Fruit oblong-ellipsoid, 15×5 cm., the subtending cupule shallow, to 5 mm. long and broad, and 2 mm. deep, crowned by the remnants of the partially deciduous perianth-lobes, the pedicel thickened and up to 5 mm. long, expanding slightly towards the apex.

Central Costa Rica at 600 to 1000 meters altitude, and in Panama up to 1140 meters.

CHIRIQUÍ: Boquete, Davidson 641; Bajo Mona, Robalo Trail, western slope of Cerro Horqueta, Allen 4832.

Resembles *Phoebe mexicana* and *P. costaricana*, but is readily separated from the former by its loose spreading inflorescence, and from the latter by its smaller leaves, and shorter, less densely flowered inflorescence.

2. **PHOEBE COSTARICANA** Mez & Pittier ex Mez in Bull. Herb. Boiss. II. 3:230. 1903.

Small tree 8–20 m. high; branchlets reddish chestnut, somewhat maculate, definitely angled, appressed fulvous-pubescent becoming glabrous. Leaves alternate; petioles fairly stout, glabrous, canaliculate, 7–12 (–20) mm. long; blades glabrous throughout except for glands on the lower surface, coriaceous, narrowly elliptic, 10–12 (–15) cm. long and 2.5–3.5 (–6) cm. broad, the base cuneate, the apex subacute or acute, triplinerved, the costa impressed above and more

Fig. 6. *Phoebe costaricana*

prominent throughout than the slender lateral nerves, of which the lowermost pair diverge 1–1.5 cm. from the base at an angle of about 35° , persisting well past the middle of the blade, the inconspicuous upper pairs diverging at an angle of about 55° ; pubescent axillary glands present in the axils of the lowermost pair of nerves. Inflorescence axillary and subterminal, panicles longer than the leaves, slender, broad and spreading, glabrous, few- to many-flowered, 12–19 cm. long, the peduncle 6–10 cm. long. Flowers 3–4 mm. long, the pedicels 4–5 mm. long; perianth subcampanulate, yellow or greenish white, the lobes subequal, 1.9–2.15 mm. long, ovate or ovate-elliptic, membranaceous, pubescent; stamens of ser. I & II 1.7 mm. long, the ovate anthers equaling the filaments, the stamens of ser. III to 2.15 mm. long, the oblong anthers biglandular, the glands subsessile, conspicuous, cordate; staminodia cordate, stipitate, to 1 mm. long; gynaecium glabrous, to 2.5 mm. long, the ovary ellipsoid or ellipsoid-ovoid, about equaling the slender style, the stigma triangular and not too conspicuous. Fruit ellipsoid, apiculate, 2×1 cm., the subtending cupule sometimes suburceolate, 9 mm. long, 8–12 mm. in diameter and 3 mm. deep, crowned by the persistent thickened perianth-lobes, supported by the enlarged, comparatively slender pedicel.

Native of Costa Rica and adjacent Panama, at an altitude of 1000 to 1700 meters, on forested hills. Known as *Siguá*.

CHIRIQUÍ: Bajo Mona, Boquete, *Davidson* 583; forests around Boquete, *Pittier* 2998, 3146; Finca Lérida to Boquete, *Woodson*, *Allen* & *Seibert* 1099; vicinity of Boquete, east of Río Caldera, *Allen* 4657.

Most nearly related to *Phoebe effusa*, a native of Mexico, from which it may be distinguished by differences in leaf-structure. The blades of *P. costaricana* are more attenuately cuneate; there are usually only four pairs of lateral nerves, the lowermost pair often being extremely conspicuous and bearing pubescent glands in the axils; the petioles are usually stout, glabrous or glabrescent and up to 1.5 cm. long, and the pedicels usually equal the perianth, rarely exceed it in length.

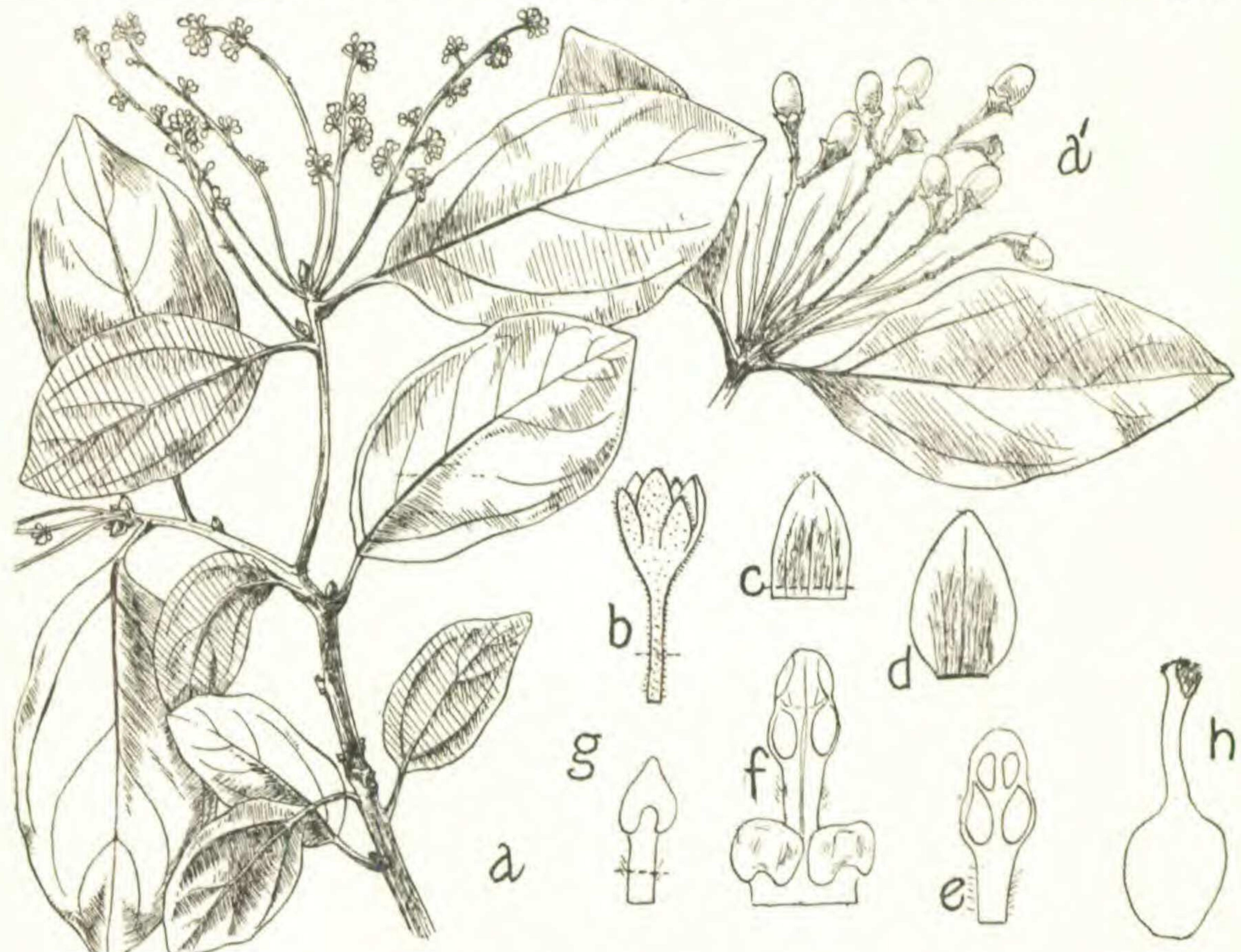


Fig. 7. *Phoebe mexicana*

3. **PHOEBE MEXICANA** Meissner in DC. *Prodr.* 15¹:31. 1864.

Small tree to 12 m. high; branchlets reddish black or reddish brown, sulcate becoming striate, grayish fulvous-pubescent becoming glabrescent at maturity. Leaves alternate; petioles stout, glabrescent becoming glabrous, canaliculate, to 2 (-2.5) cm. long; blades variously pubescent, usually glabrous above, often glabrous beneath except for the glands, coriaceous, elliptic, lanceolate- or oblong-elliptic, 15 (-26) cm. long and 5 (-10) cm. broad, the base cuneate or somewhat obtuse or rounded, the apex subacute or acuminate to caudate-acuminate, triplinerved, the costa prominently impressed above and elevated beneath, lateral nerves up to 7 pairs, slender and very obscure, the more prominent lowermost pair with usually prominent pubescent glands in their axils and diverging from the costa at an angle of about 25°, the upper pairs at an angle of about 55°. Inflorescence

of numerous axillary and subterminal, racemose panicles, pubescent becoming glabrescent, many-flowered, reddish, 10–15 cm. long, the peduncles usually 2–4 (–5) cm. long. Flowers fulvous-pubescent, small, 3–4 mm. long, sessile or with the pedicels 2 (–3) cm. long; perianth campanulate, white, the lobes thin, ovate, the three outer to 2 mm. long, the three inner to 3 mm. long; stamens of ser. I & II to 1.7 mm. long, the elliptic anthers equaling the slender filaments, the stamens of ser. III to 2.15 mm. long, the filaments biglandular, the glands subreniform, stipitate, about one-third the length of the entire stamen; staminodia narrowly cordate, stipitate, approximately 1 mm. long, the stipe slender, pubescent, slightly more than one-half the entire length; gynoecium glabrous, 2.5 mm. long, the ovary broadly ellipsoid to ovoid, less than one-half the length of the slender style, the stigma conspicuous, slightly dilated, discoid, or deltoid. Fruit slightly ovoid, apiculate, about 1 cm. long and 7 mm. broad, the subtending cupule campanulate, 5 mm. long, 7 mm. in diameter and 2 mm. deep, bearing the brittle remains of the persistent perianth-lobes, the pedicel being enlarged to about 5 mm. in length.

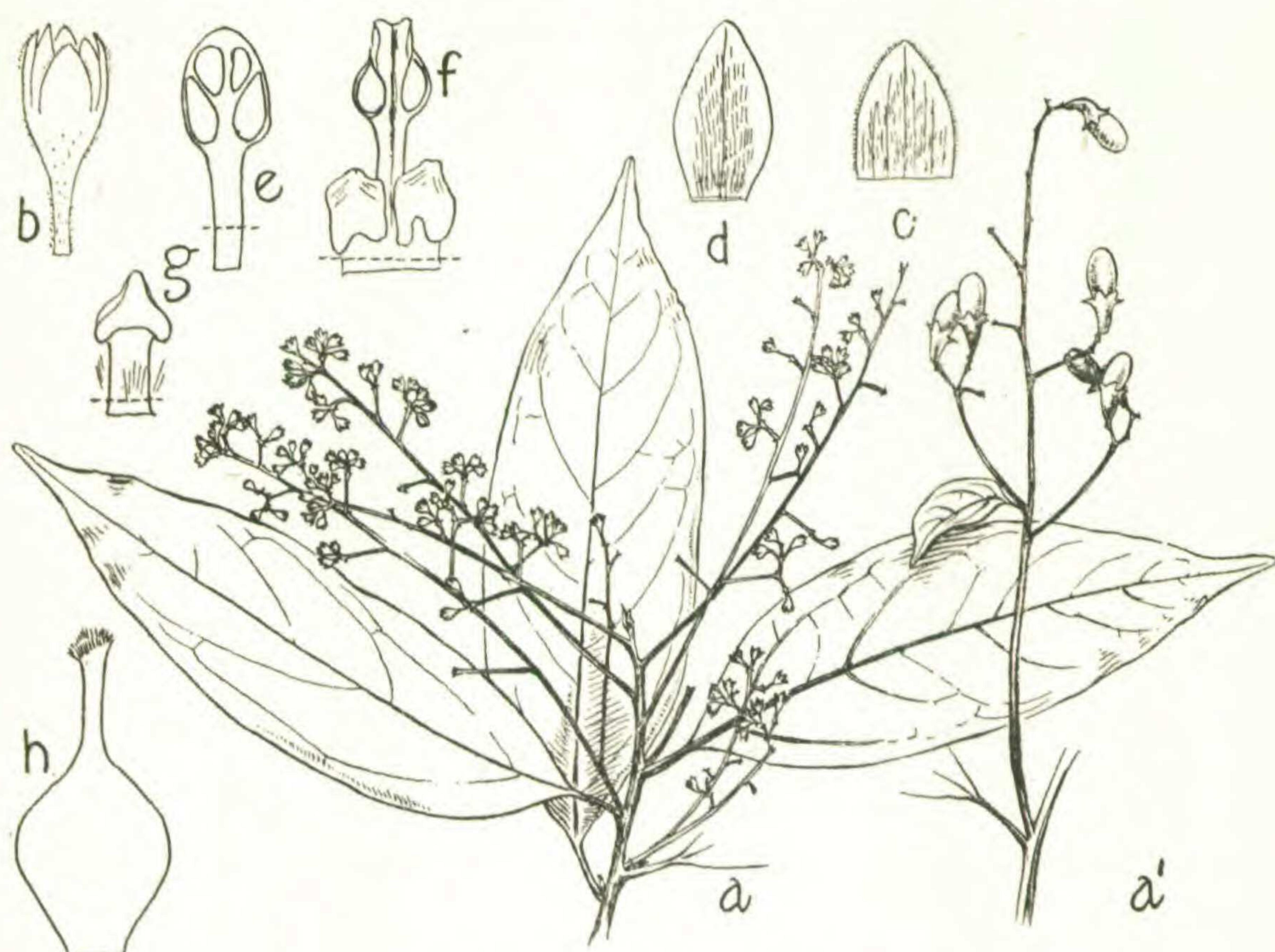
Found generally throughout southwestern Mexico and Central America, at varying altitudes from 15 meters along the coast to 2800 meters in the mountains of Guatemala.

CANAL ZONE: near Culebra, Pittier 3438; hospital grounds at Ancon, Pittier 3957.

Distinct because of the numerous strict raceme-like panicles with short branchlets, borne so close to the main axis as to give a spike-like appearance. In the specimens from Panama, the leaf-blades are more coriaceous, shorter, more definitely elliptic, and more blunt at the apex. In all other respects, however, the Panamanian trees resemble those growing farther north.

4. *PHOEBE JOHNSTONII* C. K. Allen in Jour. Arnold Arb. 26:433. 1945.

Small, often bushy aromatic trees to 15 m. high; branchlets reddish, striate, gray-sericeous becoming at length glabrous. Leaves alternate; petioles reddish, pubescent becoming glabrous, slender, canaliculate, up to 1.5 cm. long; blades glabrous above and beneath except for the nerves and axillary glands, shining and olive-green above, pale beneath, in the young stages membranaceous becoming parchmentaceous, lanceolate-elliptic, 8–14 cm. long and 2.5–4.5 cm. broad, the extreme base narrowly cuneate or attenuately cuneate throughout, the apex obtusely and attenuately acuminate or subcaudate-acuminate, subtriplinerved, the nervation pale reddish, the lateral nerves, of which there are 4 or 5 pairs, slender, the lowermost pair diverging from the costa at an angle of 25–35°, and more conspicuous than the upper pairs which diverge at an angle of 45°; axillary glands of the lowermost pair of nerves less obscure than those of upper pairs. Inflorescences axillary and subterminal, numerous, racemose or rarely broad panicles up to 12 cm. long, early yellow-white becoming reddish, the peduncle to 2 (–3) cm. long, striate, pubescent becoming glabrescent. Flowers to 4 mm. long, the pedicels to 3 mm. long; perianth subcampanulate, pale yellow, lobes subequal, ±2.4–3

Fig. 8. *Phoebe Johnstonii*

mm. long, ovate, elliptic or elliptic-lanceolate, membranaceous, pubescent; stamens of ser. I & II \pm 1.7 mm. long, the ovate anthers equaling the filaments, the stamens of ser. III \pm 2 mm. long, the subovate anthers emarginate and bi-glandular, the glands subsessile, conspicuous, reniform; staminodia ovate, subcordate, stipitate, to 1.15 mm. long; gynoecium glabrous, \pm 2.5 mm. or more long, the ovary ovoid or subglobose, almost equaling the slender style, the stigma subcapitate, somewhat conspicuous. Fruit green, glabrous, ellipsoid, minutely apiculate, 1 cm. \times 7 mm., the subtending cupule 5 mm. long, 7 mm. in diameter and 4 mm. deep, crowned by the persistent, slightly thickened, reddish perianth-lobes, supported by the thickened, reddish pedicel up to 6 mm. long.

Native to Panama at low altitudes, although collected on the mainland only on the hospital grounds at Ancon, Canal Zone, and to San José Island of the Perlas Archipelago, where it occurs abundantly according to the collector.

CANAL ZONE: hospital grounds at Ancon, Pittier 2750. PANAMÁ: San José Island, Perlas Archipelago, Gulf of Panama, Johnston 505, 512, 553, 583, 666, 667, 697, 713, 773; WITHOUT LOCALITY: Hayes 1017, 1018.

Similar to *Phoebe mexicana* found throughout Mexico and Central America, and to *P. Ehrenbergii* of Mexico, but easily separated from the former by the shorter panicles bearing flowers that are never whitish gray-pubescent, and by leaf-blades that are thinner in texture and on the whole more narrow. From the latter it may be separated by the many-flowered inflorescences, usually not more than 8 cm. long, with flowers not more than 4 mm. long and never pruinose.

Fig. 9. *Phoebe Pittieri*

5. PHOEBE PITTIERI Mez in Bot. Jahrb. 30, Beibl. 67:16. 1901.

Small tree or shrub 3–5 m. high; branchlets fulvous- or yellowish-tomentose, somewhat sericeous in the very young stages, becoming fuscous and harsh to the touch. Leaves alternate or subopposite, near the apex of the branchlet; petioles pubescent, shallowly canaliculate, up to 1 cm. long; blades glabrous and almost shining above except for the pubescent venation, roughly pubescent beneath, subcoriaceous or parchmentaceous, lanceolate or elliptic, 7 (–9) cm. long and 2.5–3 cm. broad, the base cuneate, the apex acuminate to obtusely acute, pinninerved, the nervation conspicuously pubescent beneath, the costa slightly elevated and pubescent above and prominently so beneath, the lateral nerves usually 5 pairs, slender and obscure above and prominently elevated beneath, diverging from the costa at an angle of 35–45°, with inconspicuous axillary glands, reticulation obscure above, more prominent beneath. Inflorescence axillary, panicles pubescent becoming glabrescent, purplish, few-flowered, not more than 5.5 (–7) cm. long, the peduncles up to 2 (–4) cm. long. Flowers up to 5 mm. long, the slender filamentous pedicels up to 8 mm. long; perianth spreading campanulate, white (purplish in the dried state), the lobes subequal, 3 mm. long, thick, papillose, elliptic, often reflexed; stamens of ser. I & II 1.7 mm. long, the roundish or ovate anthers equaling or longer than the filaments, the stamens of ser. III approximately equal in length to or longer than the outer series, the oblong or square anthers equaling the biglandular filaments, the glands large, sessile or only slightly stipitate; staminodia broadly ovate, subcordate, stipitate, 1–1.5 mm. long, the stipe

broad and spreading at the apex, pubescent two-thirds the entire length; gynoecium glabrous, 2.8 mm. long, the ovary somewhat obovoid or occasionally subglobose, longer than the style, the stigma rather inconspicuous, discoid, deltoid. Fruit greenish to purple, ellipsoid, 12–15 × 9–11 mm., the subtending cupule flaring, undulate, fluted, cyathiform, reddish, 5 mm. long, 9 mm. in diameter and 3 mm. deep, the enlarged pedicel up to 1 cm. long and expanded to 4 mm. in diameter at the apex.

Woods of Costa Rica and Panama, at an altitude of 1050 to 2200 meters, usually in moist woods; cloud forests of San Salvador, at an altitude of 2000–2150 meters.

CHIRIQUÍ: cloud- and rain-forests of Cerro Horqueta, *von Hagen & von Hagen* 2031, 2070.

Most outstanding for the pinninerved leaves which are clothed with a rough pubescence harsh to the touch, and the branchlets which are early sericeous, becoming fulvous- or yellowish-tomentose and finally fuscous.

3. OCOTEA Aublet

OCOTEA Aublet, Pl. Guian. 2:780, t. 310. 1775.

Oreodaphne Nees, Pl. Laurin. 15. 1833.

Dendrodaphne Beurling in Vet. Akad. Handl. Stockholm 1854:145. 1856.

Sassafridium Meissner in DC. Prodr. 15¹:171. 1864.

Evergreen trees or shrubs. Leaves usually alternate, occasionally subverticillate or subopposite, the blades pinninerved. Inflorescence generally axillary or sub-terminal, paniculate. Flowers usually perfect, occasionally dioecious, usually distinctly pedicellate. Perianth-tube conspicuous or lacking entirely. Perianth-lobes equal or at most subequal, thin and membranaceous to thick, fleshy and papillose, mostly deciduous. Two outer series of stamens in the perfect flowers variously shaped with filaments of varying lengths; anthers with or without connective tissue, with 4 introrse cells arranged in 2 planes, one above the other. Inner series of stamens with longer filaments bearing 2 sessile or stipitate glands varying in size and shape; anthers with 4 cells extrorse, or the 2 upper lateral and the 2 lower extrorse. Staminodia, if present, usually aborted. Gynoecium usually entirely glabrous, the style rarely pubescent. Stigma usually conspicuously triangular and often decurrent, occasionally inconspicuous and somewhat discoid. First three series of stamens of dioecious pistillate flowers replaced by staminodia with variously developed anthers; gynoecium as in perfect flowers. Stamens of stamine flowers well developed; gynoecium absent or aborted. Fruit a berry borne in a usually simple-margined cupule that is flat and disk-like or campanulate to hemispherical, with an undulate margin supported by an enlarged pedicel.

A genus consisting of approximately 340 recognized species centered, except for 27 or so which occur in Madagascar and the Mascarene Islands, in tropical America. About 21 of the American species are to be found in the West Indies,

5 in Mexico, 29 in Central America, and the remaining in South America, the South American ones being native to Brazil. Further study may show the Madagascar and Mascarene species to belong to another genus. Used for furniture, interior construction, and one species for marine construction because of durability of the timber.

- a. Largest leaf-blades not less than 20 cm. long.
- b. Leaf-blades heavily coriaceous, and densely and conspicuously reticulate and shining above.
 - c. Leaf-blades pubescent beneath; petioles pubescent..... 1. *O. COOPERI*
 - cc. Leaf-blades glabrous beneath; petioles glabrous.
 - d. Leaf-blades elliptic, prominently shining above, base cuneate, 6 (-9) pairs lateral nerves..... 2. *O. SEIBERTII*
 - dd. Leaf-blades elliptic to subobovate, somewhat shining above, the base attenuate, 12 or more pairs lateral nerves..... 3. *O. GLOMERATA*
- bb. Leaf-blades variable in texture, and, if densely reticulate, not conspicuously so and not shining above.
 - c. Leaf-blades conspicuously ferruginous- or subferruginous-tomentose beneath; venation conspicuously pubescent; inflorescence densely ferruginous- or subferruginous-tomentose..... 4. *O. PALMANA*
 - cc. Leaf-blades glabrous or glabrescent beneath, not conspicuously ferruginous- or subferruginous- or brownish-tomentose.
 - d. Leaf-blades definitely obovate.
 - e. Base of leaf-blades decurrent, sometimes very conspicuously so, and recurved..... 5. *O. IRA*
 - ee. Base of leaf-blades never conspicuously decurrent or recurved.. 6. *O. WEDELIANA*
 - dd. Leaf-blades elliptic or oblong-elliptic or oblanceolate.
 - e. Leaf-blades membranaceous.
 - f. Largest leaf-blades not more than 9.5 cm. broad; lateral nerves 6-9 pairs; petioles to 1 cm. long..... 6. *O. WEDELIANA*
 - ff. Largest leaf-blades 10-13 cm. broad; lateral nerves 12-16 pairs; petioles to 1.5 cm. long..... 7. *O. ATIRRENSIS*
 - ee. Leaf-blades not membranaceous.
 - f. Leaf-blades coriaceous, brownish or castaneous, or greenish, not more than 6.5 cm. broad, reticulation of the upper surface prominulous..... 8. *O. PAULII*
 - ff. Leaf-blades chartaceous, greenish to light brown, up to 10 cm. broad; upper surface very smooth..... 9. *O. DENDRODAPHNE*
 - aa. Largest leaf-blades not more than 17 cm. long.
 - b. Leaf-blades variable, usually not obovate, but elliptic, lanceolate-elliptic or oblong, or variations of these shapes, acute or rounded, always chartaceous; margin always finely undulate, appearing crisped on drying; petioles usually blackish; bark grayish; bases not decurrent or recurved..... 10. *O. VERAGUENSIS*
 - bb. Leaf-blades not obovate (except sometimes in *O. Austinii*); margin not consistently finely undulate.
 - c. Leaf-blades definitely oblong or oblong-elliptic, rigidly coriaceous; inflorescence to 25 cm. long.
 - d. Leaf-blades not more than 11 cm. long, densely ferruginous-sericeous beneath; bases decurrent and strongly recurved; inflorescence not more than 8 cm. long..... 11. *O. AUSTINII*
 - dd. Leaf-blades not less than 12 cm. long, glabrous throughout; bases not decurrent or recurved; inflorescence to 25 cm. long.... 8. *O. PAULII*
 - cc. Leaf-blades not oblong, or if oblong-elliptic, definitely not rigidly coriaceous; inflorescence not more than 15 cm. long.
 - d. Leaf-blades coriaceous or subcoriaceous, occasionally chartaceous, the largest usually not less than 6 cm., rarely 5 cm. broad.
 - e. Leaf-blades 12-21 cm. long; lateral nerves 6-9 pairs; flowers perfect..... 2. *O. SEIBERTII*
 - ee. Leaf-blades not more than 16 cm. long; lateral nerves 4-6 pairs; flowers dioecious.

- f. Apex of leaf-blades caudate-acuminate; venation rather obscure; reticulation obscure above..... 14. *O. CERNUA*
- ff. Apex of leaf-blades not caudate-acuminate; venation conspicuous and yellowish; reticulation somewhat prominent above..... 12. *O. RUBRINERVIS*
- dd. Leaf-blades membranaceous, the largest not more than 4.5 cm. broad..... 13. *O. SUBSERICEA*

1. *OCOTEA COOPERI* C. K. Allen in Jour. Arnold Arb. 26:335. 1945.

Tree 18–22.5 m. high; branchlets strongly angled, sulcate, densely ferruginous-tomentose becoming grayish-tomentose. Leaves alternate; petioles stout, pubescent, slightly canaliculate, 1.5 (–2) cm. long; blades glabrous and shining above except for the base of the costa, glaucous, softly tomentose beneath, brownish olive above, coriaceous, oblong, (15–) 20–35 cm. long and (5–) 9.5 (–11) cm. broad, the base roundish or obtuse, the apex acuminate, pinninerved, the costa impressed above, pubescent at the base, beneath robust, strongly elevated and pubescent, the lateral nerves 10–15 pairs, slightly impressed but almost obscure above, fairly well elevated beneath and pubescent, diverging from the costa at an angle of 45–60°, the reticulation prominent throughout. Inflorescence axillary and subterminal, paniculate, to 20 cm. long, ferruginous-tomentose, many-flowered, the apical leaves deciduous, the peduncle to 7 cm. long, ferruginous-tomentose. Flowers to 3 mm. long, the pedicels 2–3 mm. long; perianth-tube urceolate, glutinous within, the lobes yellowish brown or greenish, with unpleasant vegetable-like odor according to the collector, broadly ovate or sub-



Fig. 10. *Ocotea Cooperi*

triangular, thick or almost ligneous, to 1.7 (–2) mm. long; stamens of ser. I & II broadly spatulate, 0.6 to 1.4 mm. long, the oblong-truncate or square anthers equaling the filaments, the stamens of ser. III to 1.5 mm. long, conspicuously biglandular, the glands sessile and equaling the anthers and filaments; gynaecium glabrous, aborted, or 2.5 mm. or more long, occasionally shorter, the ovary conspicuously stipitate, broadly ovoid, twice the length of the stout style, the stigma triangular, subdiscoid, conspicuous, decurrent on the sides of the style. Fruit ellipsoid, minutely apiculate, 3.5×1.8 cm., the subtending cupule ligneous, subhemispherical, rugulose, 1.5 cm. long, 2 cm. in diameter and 11 mm. deep, the margin suberose, thin, supported by a thickened pedicel up to 1 cm. long and 5 mm. in diameter at the apex.

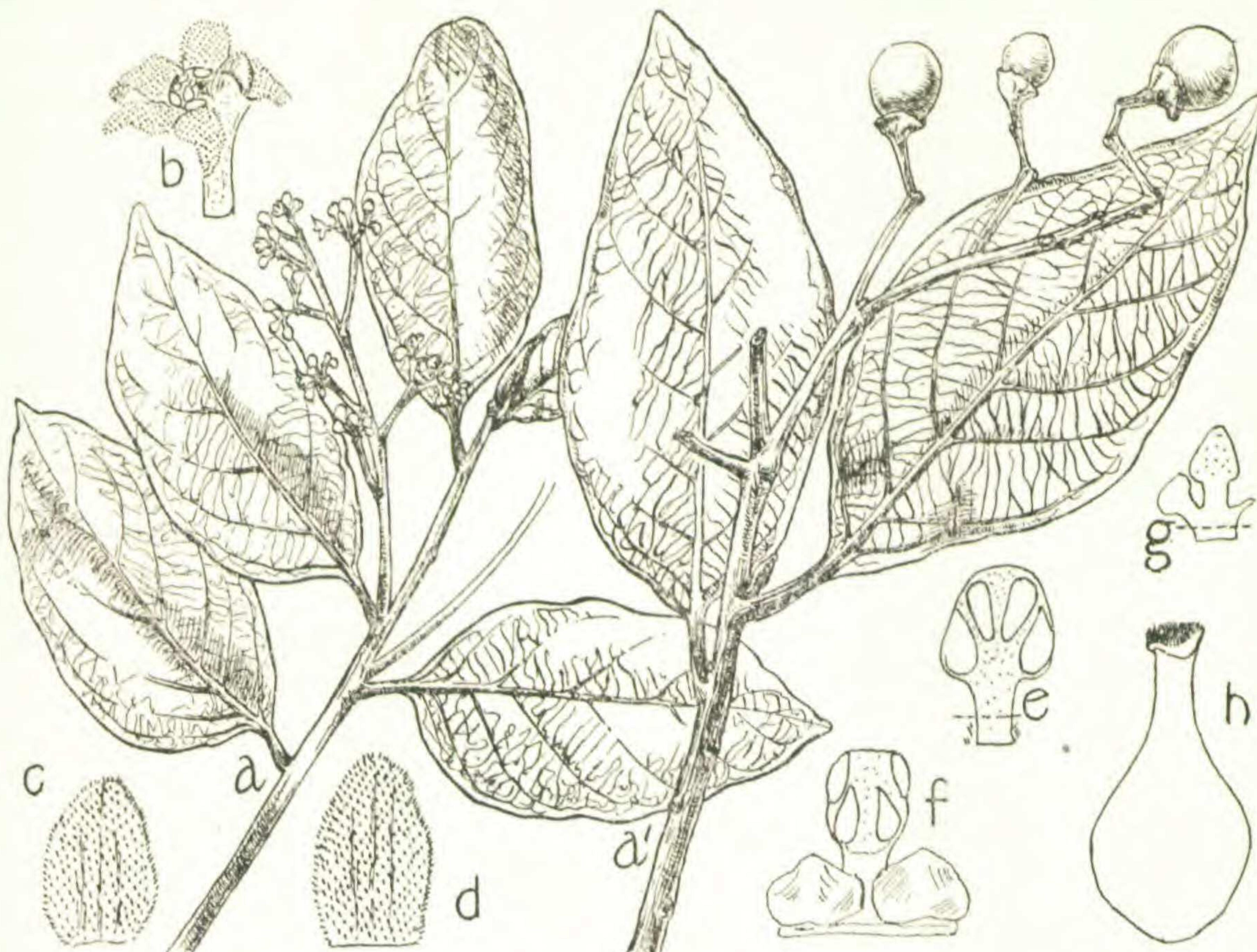
Native to Costa Rica and adjacent Panama at 675–900 meters altitude. Known as "Sweetwood," Yaya.

BOCAS DEL TORO: Changuinola Valley, Cooper & Slater 96 (Y10277); Cricamola, region of Almirante, Cooper 498.

The large, coriaceous, shining leaves and the extremely large and often lignified inflorescence bearing flowers with an urceolate perianth-tube and spatulate anthers at once distinguish this striking species. It is closely associated with *Ocotea stenoneura* from Costa Rica, but the leaf-blades of the latter are conspicuously recurved and decurrent for almost the entire length of the petioles, and the fruits are smaller, globose, and subtended by shallow disk-like undulate-margined cupules.

2. *OCOTEA SEIBERTII* C. K. Allen in Jour. Arnold Arb. 26:336. 1945.

Tree 22.5–30 m. high; branchlets angled becoming striate or sulcate, gray becoming grayish- and reddish-maculate, early pubescent becoming glabrescent or glabrous. Leaves alternate, glabrous; petioles slender or robust, glabrous, canaliculate, to 12 (–21) mm. long; blades glabrous throughout, except sometimes the costa and nerves near the base beneath, coriaceous, green in the dried state, shining above, only slightly so beneath, elliptic, 12–15 (–21) cm. long and 4.5–6 (–9) cm. broad, the base cuneate, occasionally slightly oblique, the apex slightly obtuse-acuminate, the margin recurved, penninerved, the costa reddish or yellowish, thick and slightly elevated above, prominently so beneath, the nerves 6 (–9) pairs, slightly elevated above, conspicuously so beneath, diverging from the costa at an angle of 45° , the reticulation early conspicuous throughout, presently loose above and prominently and minutely so beneath. Inflorescence axillary, paniculate, to 13 cm. long, pubescent becoming glabrous, reddish, the peduncle to 6 cm. long. Flowers up to 3 mm. long, with slender pedicels of equal length; perianth shallowly infundibuliform, the lobes more or less oblong, subacute or obtuse, thick, pubescent without, densely papillose-pubescent within, 2.8 mm. long; stamens of ser. I & II 1.25 mm. long, the anthers oblong-subrectangular, twice the length of the filaments; those of ser. III to 1.7 mm. long, conspicuously biglandular, the glands one-third the length of the stamens; staminodia subsessile to stipitate, 0.6–0.8 mm. long, ovate, frequently with aborted basal glands; gynaecium

Fig. 11. *Ocotea Seibertii*

glabrous, 2.15 mm. long, the ovary subglobose or obovoid, equaling the style, the stigma conspicuous. Fruit green, globose or slightly obovoid, apiculate, rugulose, 2.3×2 cm., the subtending cupule rugulose, glabrous, red, 5 mm. long, 3 mm. in diameter, and 3 mm. deep, the margin undulate, with a well-developed gynophore to 2 mm. long and 6 mm. in diameter, the glabrous pedicel enlarged to 4–8 mm. in length.

Native in the lowland forests of Costa Rica and Panama, up to 2285 meters altitude. Known as *Sigua amarilla*. Good timber tree, with hard wood.

CHIRIQUÍ: Valley of the Upper Río Chiriquí Viejo at Monte Lirio, Seibert 308; Chiriquí Viejo Valley, G. White 96; Quebrada Velo, vicinity of Finca Lérida, Allen 4672.

Near *Ocotea Cooperi*, but lacking the tomentum of the lower leaf-surface. Also, the fruits are obovoid or subglobose.

3. OCOTEA GLOMERATA (Nees) Mez in Jahrb. Bot. Gart. Berlin 5:294. 1889.
Oreodaphne glomerata Nees in Linnaea 21:515. 1848.

Tree or shrub; branchlets thick, conspicuously angled, ferruginous-pubescent, becoming darkened, glabrescent. Leaves alternate, the petioles robust, canaliculate, to 1.5 mm. long; blades glabrous above at maturity, shining, beneath early tomentose becoming glabrescent, glaucous, coriaceous, usually elliptic to sub-ovate, 16–25 cm. long and 4–8 cm. broad, the base acute or narrowly attenuate,

with the margin conspicuously recurved, the apex obtusely acute or somewhat acuminate, the margin recurved, pinninerved, the costa brownish, slightly elevated above, prominently so beneath, the nerves 12 or more pairs, rather obscure above, slightly elevated beneath, diverging from the costa at an angle of 45° , the reticulation conspicuous throughout, more so beneath. Inflorescences numerous, axillary, paniculate, many-flowered, 15 (-20) cm. long, ferruginous-tomentellous. Stamineate flowers 2–3 mm. long, densely pubescent, the pedicels to 1 mm. long; perianth-lobes yellow, broadly ovate, to 3 mm. long; stamens of ser. I & II 1 mm. long, the anthers ovate or ovate-oblong, 2–3 times longer than the filaments; those of ser. III 1 mm. long, oblong-subrectangular, the filaments rather broad, short, with small globose sessile glands; gynoecium glabrous, stipitiform, 1.5 mm. long. Pistillate flowers smaller than the stamineate, stamens 1 mm. long, the filaments of the outer series short, the stamens of the inner series almost sessile, the ovary equaling the very thick style, the stigma rather small. Fruit ovoid or ovoid-ellipsoid, apiculate, to 8 mm. long and 4–6 mm. broad, the cupule hemispherical, with entire margin, rugose, to 8 mm. long and 8–9 mm. broad, subtended by a relatively slender pedicel up to 2 mm. long.

Tropical America from Panama and Trinidad, Venezuela, and British Guiana south to Brazil.

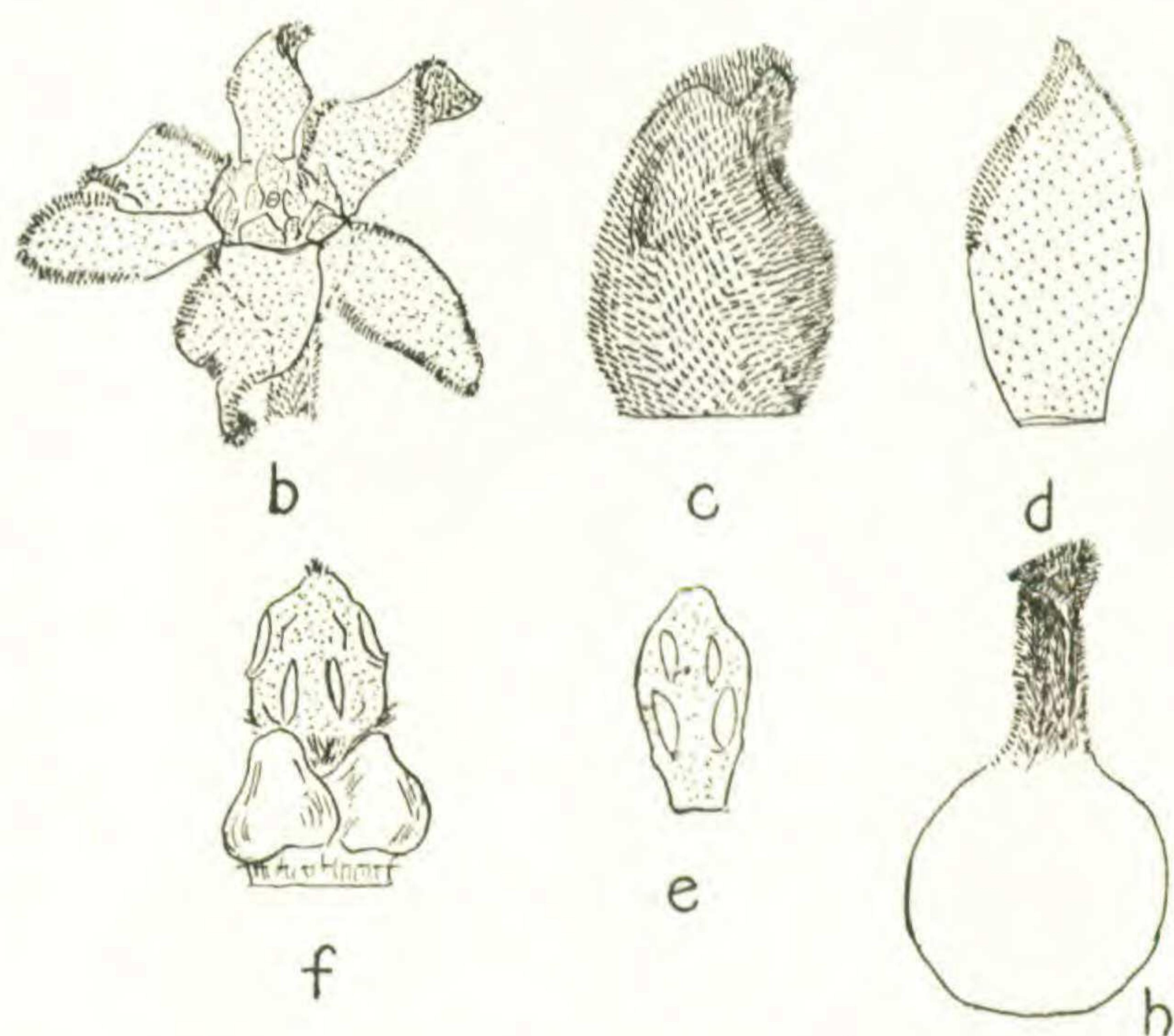
CANAL ZONE: without exact locality, *Hayes 1051*.

4. *OCOTEA PALMANA* Mez & J. D. Smith in *Bot. Gaz.* 33:258. 1902.

Tree 20 m. high, possibly more; branchlets stout, angled, densely, shortly and minutely ferruginous-tomentose. Leaves alternate; petioles thick, pubescent, striate, to 3 cm. long; blades opaque, glabrous above except for the venation, and beneath densely minutely ferruginous-tomentose, rigidly coriaceous, obovate, to 25 cm. long and 14 cm. broad, the base cuneate, the apex rounded and very shortly abruptly and obtusely acuminate to acutely acuminate, pinninerved, the costa broad, scarcely elevated above, prominently so beneath, the nerves 8–10 pairs, slender, delicately and slightly elevated above, conspicuously so beneath, diverging at an angle of $35-55^{\circ}$, the reticulation more or less obscure. Inflorescence stout, axillary, paniculate, about 8 cm. long, densely ferruginous-tomentose, rather few-flowered, the peduncle not more than 2 cm. long. Flowers large, 5–6 mm. long and about 12 mm. in diameter, densely tomentose; perianth-lobes ovate, almost leathery, 2.15–3.8 (-8) mm. long; stamens of ser. I & II 1.25–1.5 mm. long, the anthers ovate or rounded, the filaments short; those of ser. III longer, 1.7–3 mm., the filaments nearly equaling the oblong rounded anthers and completely covered by the large sessile, more or less rounded, basal glands; gynoecium glabrous, usually about 3 mm. long, the ovary ellipsoid or globose, equaling the rather stout, sometimes pubescent style, the stigma capitate or triangular. Fruit green, ellipsoid, oblong, to 3.5×1.6 cm., the subtending cupule pink, subcampanulate, to 6 mm. long, 15 mm. in diameter and 5 mm. deep, the margin very thin, the pedicel nearly 2.5 cm. long and expanded to nearly 1 cm. in diameter at the apex.

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Fig. 12. *Ocotea palmana*Fig. 13. *Ocotea palmana*

Native of Costa Rica and Panama at about 1500 meters altitude.

BOCAS DEL TORO: Fish Creek Mts., vicinity of Chiriquí Lagoon, *von Wedel* 2264.

This stout robust species stands out because of the large obovate leaf-blades that are rigidly coriaceous, are covered beneath with a dense fine close ferruginous tomentum, and have 8–10 pairs of slender lateral nerves delicately elevated above and conspicuously so beneath. The large densely tomentose flowers with rough almost leathery lobes are also outstanding.

5. *OCOTEA IRA* Mez & Pittier ex Mez in Bull. Herb. Boiss. II. 3:232. 1903.

Tree? 6–20 m. high; branchlets angled, darkish, early closely appressed, brownish-, almost sericeous-pubescent, becoming glabrous. Leaves alternate; petioles strongly or slightly winged, up to 1 cm. long, or the decurrent recurved blade forming an apparent petiole of nearly 4 cm.; blades glabrous to glabrescent, with frequently inconspicuous axillary glands, opaque, subcoriaceous to rigid, obovate, to 25 cm. long and 9.5 cm. broad, the base cuneate and recurved, the apex abruptly and obtusely acuminate, pinninerved, the costa broad and conspicuous although slightly impressed above, prominently elevated beneath, the nerves slender, 9–12 pairs, very slightly elevated above, more so beneath, diverging at an angle of about 35–45°, curving toward the marginal region, the reticulation inconspicuous above and frequently pubescent beneath. Inflorescence axillary and subterminal, panic-



Fig. 14. *Ocotea Ira*

ulate, to 15 cm. long, brownish-pubescent, becoming glabrous, many-flowered, the stout peduncle to 7 cm. long. Flowers small, 2.15 mm. long, equaling the slender pedicel in length, the perianth pubescent without, the lobes thick, papillose, ovate, acute, to 1.4 mm. long; stamens of ser. I & II 0.8–1.25 mm. long, the anthers ovate, obtuse, scarcely longer than the slender filaments; those of ser. III 1–1.7 mm. long, the anthers subrectangular, truncate, not quite equaling the pubescent filaments, glands subglobose, subsessile, sometimes to one-half the length of the filaments; gynoecium glabrous, up to 1.4–2.4 mm. long, the ovary subellipsoid, slightly longer than the slender style, the stigma subtriangular, subdiscoid. Fruit unknown.

Native to Costa Rica and adjacent Panama, in the lowlands, at not more than 200 meters altitude. Known as *Aguacatón*.

BOCAS DEL TORO: region of Almirante, Cricamola Valley, Cooper 532; Water Valley, von Wedel 720; vicinity of Chiriquí Lagoon, von Wedel 1382. CHIRIQUÍ: in lowlands, Cooper & Slater 218 (Y 10571); Progreso, Cooper & Slater 309 (Y 10660).

Resembles *Ocotea Tonduzii* and its allies in the shape of the leaf-blades and the decurrent leaf-bases, but the leaf-blades are much larger on the whole than those of *O. Tonduzii*.



Fig. 15. *Ocotea Wedeliana*

6. *OCOTEA WEDELIANA* C. K. Allen in Jour. Arnold Arb. 26:339. 1945.

Tree 3–12 m. high; branchlets more or less angled or alate, brown, reddish or gray, minutely and inconspicuously pubescent becoming glabrous. Leaves alternate; petioles often stout, canaliculate, pubescent, to 1 cm. long; blades early fulvous-sericeous, quickly glabrous, membranaceous, opaque, obovate or elliptic, to 26 cm. long and 9.5 cm. broad, base cuneate, apex obtuse, acuminate or long-caudate-acuminate, pinninerved, the costa impressed above, elevated beneath, the lateral nerves 6–8 (or 9) pairs, slightly elevated above, prominently so beneath, diverging from the costa at an angle of 35–45°, the reticulation obscure above, rather prominulous beneath. Inflorescence axillary or subterminal, paniculate, to 12 cm. long, glabrescent, few-flowered, the peduncle slender, up to 7.5 cm. long. Flowers to 3.5 mm. long, the slender pedicels to 4.5 mm. long; perianth fulvous-pubescent, the tube conspicuous, the lobes broadly ovate, acute, thick, to 2.15 mm. long; stamens of ser. I & II 1.25–1.7 mm. long, the anthers ovate, obtuse, 3–4 times longer than the stout pubescent filaments; those of ser. III 1.5–2 mm. long, the anthers narrowly ovate, pubescent at the base, twice the length of the filaments, the glands reniform, conspicuous, sessile, equaling the filaments; gynoecium glabrous, 1.7–2.15 mm. long, the subglobose to ovoid ovary equaling the slender style, the stigma conspicuous, discoid. Fruit green, globose, glabrous, to 1 cm. in diameter, the subtending cupule shallow, undulate, red, to 2 mm. long, 8 mm. in diameter and 2 mm. deep, the pedicel red, glabrous, to 8 mm. long and enlarged to 2 mm. in diameter at the apex.

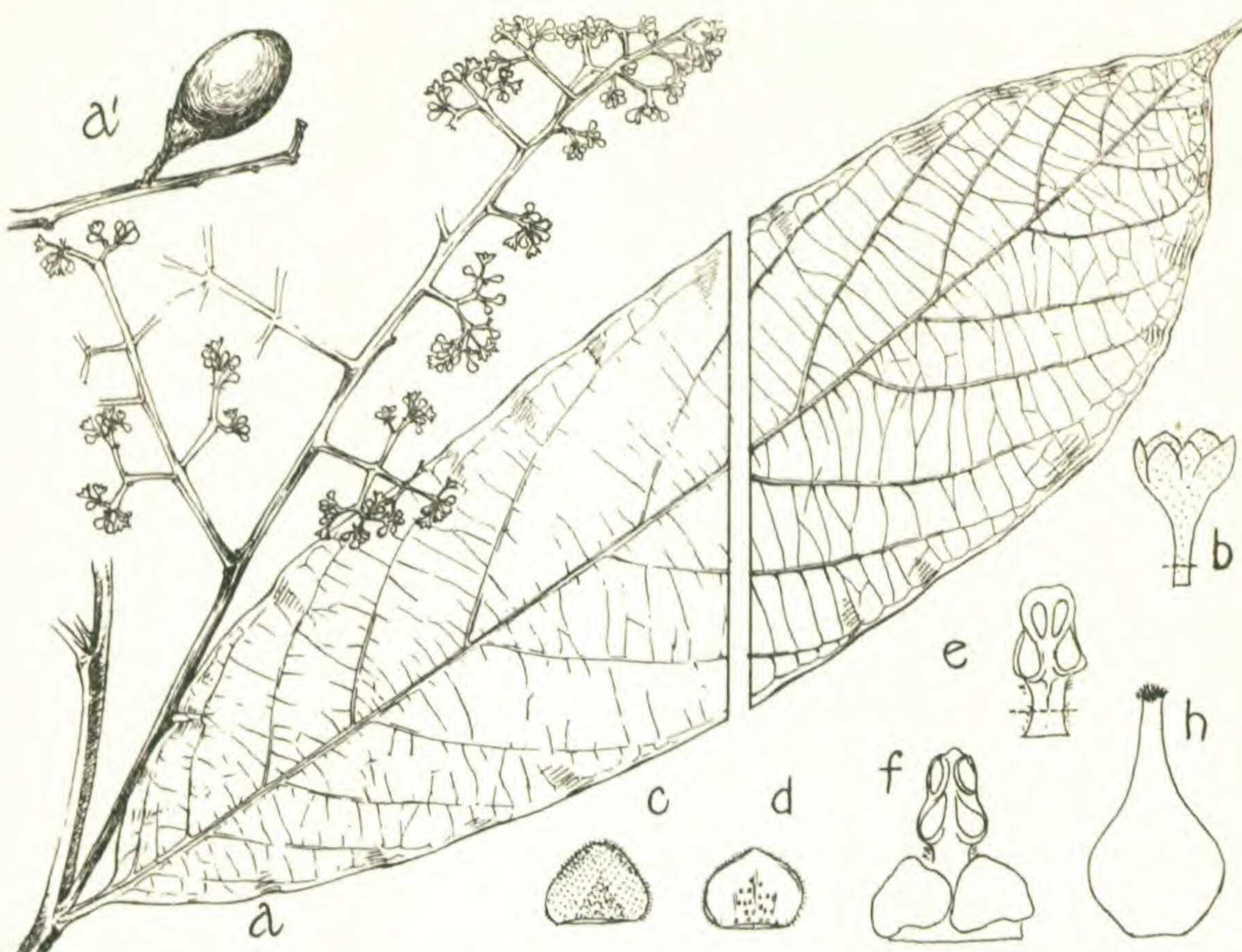
Found to date only from northern Panama, at 375 meters altitude. Known as *Sigua*.

BOCAS DEL TORO: without locality, *von Wedel* 388, *Cooper* 399, 399a; Buena Vista Camp, on Chiriquí Trail, *Cooper* 603 (Y 12236). COLÓN: vicinity of Cerro Jefe, *Allen* 3439.

Similar in foliage and floral characters to *Ocotea nicaraguensis* from Nicaragua and Costa Rica, but differs in the texture and size of the leaf-blades. Possibly to *O. nicaraguensis* belongs *Allen* No. 3709, a fruiting specimen collected north of El Valle de Anton in the province of Coclé, at an altitude of 1000 meters. This number, however, has leaves much smaller than those usually found in *O. nicaraguensis*.

7. *OCOTEA ATIRRENSIS* Mez & J. D. Smith ex Mez in Bot. Jahrb. 30, Beibl. 67:18. 1901.

Shrub? 3–5 m.; branchlets angled, reddish, early densely minutely ferruginous-pubescent, quickly glabrescent or glabrous. Leaves alternate; petioles stout, canaliculate, glabrescent except for residue of dense pubescence in groove, to 1.5 cm. long; blades glabrous to glabrescent, membranaceous, opaque above, darker beneath, oblong or oblanceolate-elliptic, to 38 cm. long and 6–10 (–13) cm. broad, the base roundish, obtuse or obtusely cuneate, the apex caudate-acuminate, pinninerved, the costa broad, impressed above, the lateral nerves 12–16 pairs,

Fig. 16. *Ocotea atirrensis*

rather obscure above, prominently elevated beneath, diverging from the costa at an angle of 45° , the reticulation visible, only slightly elevated above, more prominently so beneath. Inflorescence axillary, paniculate, 15–20 cm. long, pubescent becoming glabrescent, the peduncle to 8 cm. long. Flowers to 3 mm. long, glabrescent, the pedicel glabrescent, not more than 2 mm. long, the perianth-tube well defined, the lobes ovate-elliptic or even broadly ovate, obtuse, somewhat thin, papillose within, 1.25 mm. long; stamens of ser. I & II 0.8 to 1 mm. long, the anthers ovate, subrotund or obtuse, twice the length of the filaments; those of ser. III 1.25–1.7 mm. long, the anthers ovate, obtuse, the slightly shorter filaments bearing sessile subreniform basal glands; gynoecium glabrous, 1.7–2 mm. long, the ovary ovoid to subglobose, equaling the style, the stigma usually inconspicuous, obtuse. Fruit black, fleshy, ellipsoid, 3.3×1.5 cm., the subtending cupule shallow, disk-like, the margin undulate, 8 mm. long, 8 mm. in diameter, and less than 2 mm. deep, the pedicel very short, slightly enlarged to 2 mm. at the apex.

Occurs in Costa Rica and adjacent Panama, usually between 600 and 850 meters, occasionally to 1550 meters altitude. Known as *Quizarra* in Costa Rica. Often myrmecophilous.

BOCAS DEL TORO: vicinity of Chiriquí Lagoon, von Wedel 1399.

A striking species, because of the very long-acuminate caudate, membranaceous, oblanceolate leaf-blades. More nearly related to *Ocotea Paulii*, but separated readily by the texture and reticulation of the leaf-blades.

Fig. 17. *Ocotea Paulii*

8. OCOTEA PAULII C. K. Allen in Jour. Arnold Arb. 26:345. 1945.

Tree (or scandent shrub?) to 15 m. high; branchlets angled, brown becoming gray, sulcate, glabrous. Leaves alternate or subopposite, glabrous; petioles stout, glabrous, reddish black, 1 (-1.5) cm. long; blades glabrous throughout, coriaceous, more or less greenish brown or castaneous in the dried state, oblong, to 20 cm. long and 5-6.5 cm. broad, the base cuneate, often abruptly so, the apex abruptly and obtusely acuminate or rounded or obtuse, sometimes emarginate, pinninerved, the costa uniformly thick, reddish, somewhat elevated above, conspicuously so beneath, the nerves 8-12 pairs, inconspicuously elevated above, conspicuously so beneath, diverging from the costa at an angle of 45°, the reticulation somewhat prominulous throughout. Inflorescence axillary or subterminal, broadly paniculate, to 25 cm. long, glabrescent, reddish, many-flowered, peduncle reddish, to 6 cm. long. Flowers to 2 mm. long, pedicels slender, to 2 mm. long, perianth campanulate, pale yellowish, lobes broadly ovate, obtuse, or subacute, membranaceous, 1.25-1.5 mm. long; stamens of ser. I & II 1 mm. long, the anthers ovate, twice the length of the filaments; those of ser. III 1.25-1.7 mm. long, the anthers ovate-quadrata, the glands stipitate; gynoecium glabrous, 1.7 mm. long, ovary broadly ovoid or subglobose, equaling the style, the stigma conspicuous. Fruit black on drying, oblong, 18-20 × 10-11 mm., the subtending cupule shallow, subhypocrateriform, rugulose, glabrous, 2 mm. long, 5-6 mm. in diameter, and 1 mm.

deep, the margin undulate, the pedicel somewhat enlarged, glabrous, 3–4 mm. long.

Costa Rica, in cloud-forests of the Pacific watershed, up to 1450 meters altitude, and Panama up to 1100 meters.

CHIRIQUI: between Cerro Vaca and Hato del Loro, Pittier 5395. COCLÉ: vicinity of El Valle, Allen 1211, 1775, 2848.

Distinguished by the coriaceous leaf-blades, which are bright brown on drying.

9. OCOTEA DENDRODAPHNE Mez in Jahrb. Bot. Gart. Berlin 5:238. 1889.

Dendrodaphne macrophylla Beurling in Vet. Akad. Handl. Stockholm 1854:145. 1856.

Small shrub to tree, to 22.5 m. high; branchlets angled, usually silvery gray, early closely minutely pubescent, quickly becoming glabrous. Leaves alternate; petioles glabrous, stout, canaliculate, blackish, presenting a striking contrast to the pale branchlets, up to 2 cm. long; blades glabrous throughout, or with a few dark hairs persisting at the base on the lower surface, chartaceous, usually pale green to light brown in the dried state, elliptic or oblong-elliptic, to 30 cm. long and 10 cm. broad, the base obtuse or abruptly cuneate, rarely rounded and abruptly cuneate, the apex variable, obtuse or acutish, or even acuminate to caudate-acuminate, pinninerved, the costa robust, slightly impressed above and prominently elevated beneath, the lateral nerves to 9 or 10 pairs, delicately and imperceptibly elevated above and more prominently beneath, diverging at an angle

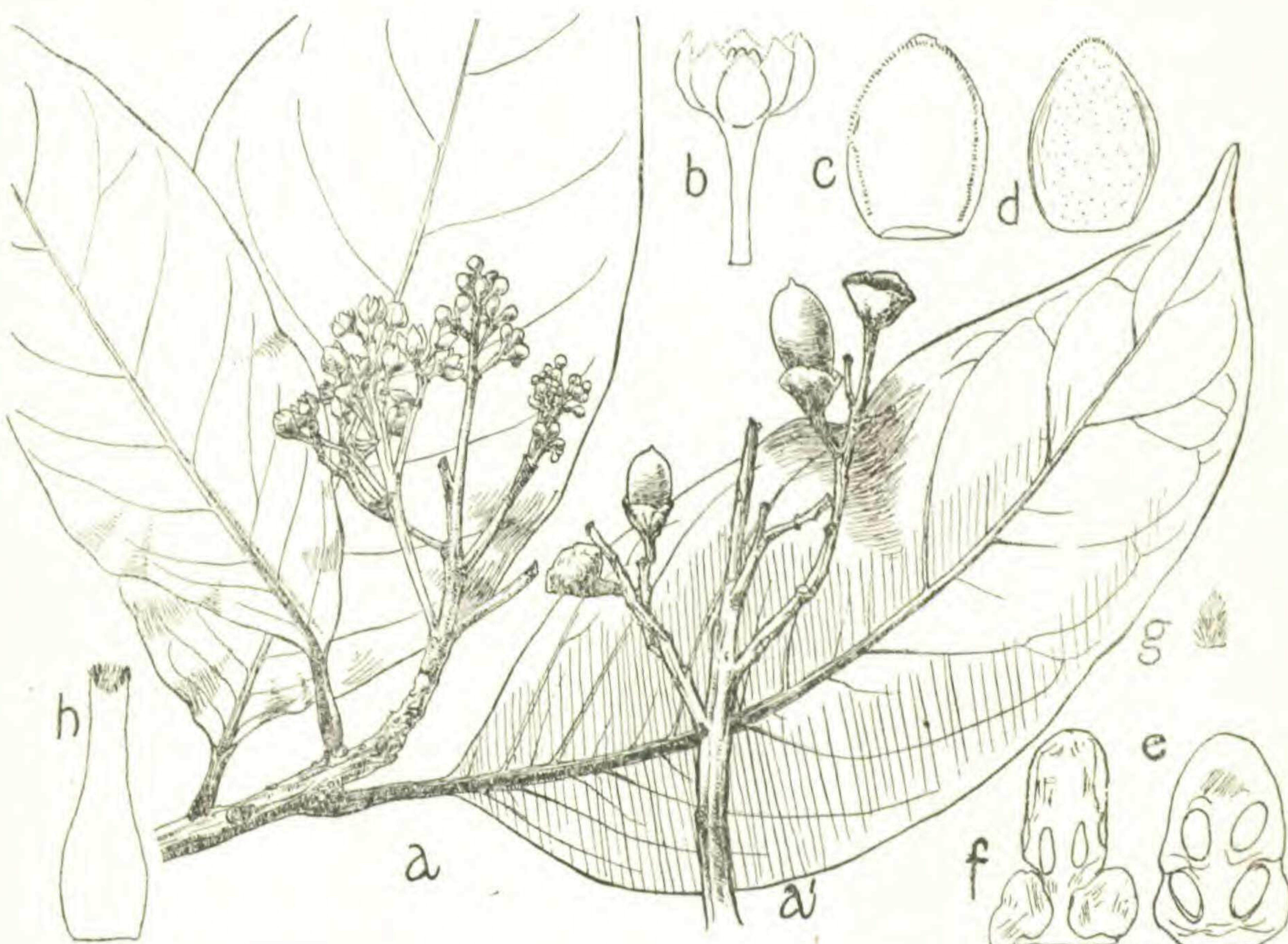


Fig. 18. *Ocotea Dendrodaphne*

of about 45° , the upper surface very smooth, the lower minutely and densely reticulate. Inflorescences numerous, subterminal, panicles 5–10 (–15) cm. long, pubescent, much-branched, many-flowered, the peduncles not more than 4.5 cm. long, usually less. Flowers variable, (3–) 4–6 mm. long, perianth-lobes elliptic, oblong, or ovate-elliptic, fleshy, papillose, 3–5 mm. long; stamens of ser. I & II 1.7–2.8 mm. long, the anthers ovate, acutish or obtuse, petaloid with conspicuous connective tissue one-third their length, the filaments short, stout; those of ser. III 1.7–3.2 mm. long, the filaments longer, the glands small, subsessile; staminodia, if present, variable, subsessile, triangular or cordate, pubescent to glabrous, to 0.6 mm. long; gynoecium glabrous, 2.15–2.4 mm. long, the ovary probably ovoid, the style stout, the stigma usually conspicuous, capitate or decurrent. Fruit black, ellipsoid, 2.3×1.2 cm., the subtending cupule cyathiform, woody, glabrous, 1 cm. long, 14 mm. in diameter and 6 mm. deep, the double margin slightly undulate and obscurely lobed, the pedicel rather thick, striate, pubescent to glabrous, to 6 mm. long.

Widespread from Mexico through Guatemala, Honduras, Costa Rica, and Panama from 200 to about 1250 meters altitude.

COCLÉ: hills north of El Valle de Anton, vicinity of La Mesa, *Allen* 2299.

Outstanding because of the silvery gray angled branchlets and stout blackish petioles, which subtend pale greenish leaf-blades that are unusual in that they show no reticulation on their upper surface. The fruits are borne in cupules which show a tendency toward a double margin. The species is similar to *Ocotea veraguensis*, in the cupule character, the blackish petioles, and the gray angled branchlets.

10. *OCTEA VERAGUENSIS* (Meissner) Mez in Jahrb. Bot. Gart. Berlin 5:240. 1889.

Sassafridium veraguense Meissn. in DC. Prodr. 15¹:171. 1864.

Tree or shrub 3–10 m. high; branchlets finely gray- or tawny-sericeous, quickly becoming pale gray, glabrous, striate. Leaves alternate or subopposite; petioles stout, canaliculate, blackish, glabrescent, to 1 (–1.5) cm. long; blades early soft grayish-pubescent beneath, becoming entirely glabrous, chartaceous, usually uniformly pale grayish green, the upper surface very smooth, elliptic, lanceolate-elliptic, oblong, oblong-elliptic, rarely obovate, variable in size, (4–) 9 (–13) cm. long and (2–) 4 (–7) cm. broad, the base obtuse or cuneate, the apex rounded-obtuse or obtusely acute, the margin in the dried state usually conspicuously minutely undulate or crisped, pinnerved, the costa very prominent above and beneath, although only slightly elevated above and more conspicuously so beneath, the nerves 6 or more pairs, obscure above, only faintly visible beneath, the reticulation also obscure. Inflorescence axillary, paniculate, 3–13 cm. long, grayish-pubescent to glabrescent, many-flowered, the ultimate branchlets frequently giving

the appearance of a capitulum, the peduncle up to 4–6 (–9) cm. long. Flowers to 5 mm. long, more than twice that in diameter at anthesis, pubescent, pedicels slender, pubescent, to 6 mm. or more long; perianth-tube well developed, the lobes oblong or elliptic, obtuse or acutish, thick, fleshy, papillose, to 3–3.5 mm. long; stamens of ser. I & II 2.4 mm. long, anthers petaloid, obovate, nearly sessile, the protruding papillose connective more than one-third the entire length; those of ser. III longer, the anthers with short filaments, the glands conspicuous, short-



Fig. 19. *Ocotea veraguensis*

stipitate or sessile, often nearly the length of the anthers; staminodia, if present, variable, linear or with stipitate ovate head, always pubescent, 0.6–0.9 mm. long; gynoecium glabrous, to 2.15 mm. long, the ovary ellipsoid to subglobose, usually twice the length of the tapering style, the stigma conspicuous, triangular. Fruit (immature?) greenish or light brown, not very firm in texture, ellipsoid, apiculate, to 1.7×1 cm., the subtending cupule shallow, thinnish, to 5 cm. long, 12 mm. in diameter and 3–4 mm. deep, the margin distinctly double, the outer somewhat thickened and undulate, the inner plane, paler in color, minutely pubescent, and protruding beyond the outer for less than 1 mm., the pedicel to 1 cm. long, enlarging towards the apex to about 3 mm. in diameter.

General in forests throughout the coastal regions from Mexico to Panama (*Pacific tierra caliente*), usually at very low altitudes (to 120 meters), occasionally inland as high as 1200 meters. The wood is used in some localities for construc-

tion. Some parts of the tree are used by the natives of Nicaragua as a tonic. Known by a variety of native names in each locality, *Sigua canelo* in Panama.

CHIRIQUÍ: vicinity of San Felix, Pittier 5278; along river bank, east of Gualaca, Allen 5038. VERAGUAS: "near Veraguas," Warscewicz 174. COCLÉ: Penonomé and vicinity, Williams 236. PANAMÁ: Río Las Lajas, Allen 1611.

For affinities, see the preceding species.

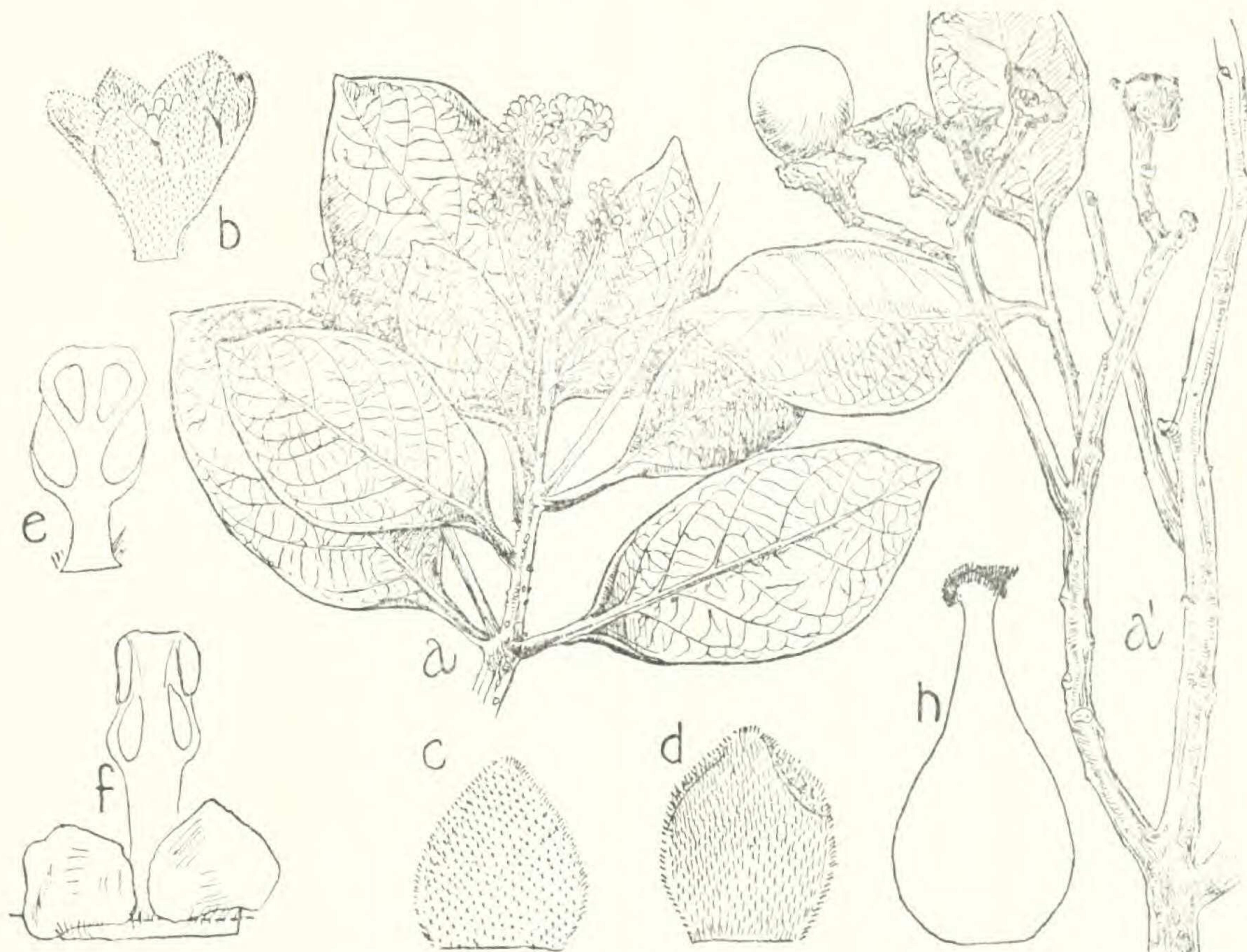


Fig. 20. *Ocotea Austinii*

11. *OCOTEA AUSTINII* Allen in Jour. Arnold Arb. 26:350. 1945.

Tree 10–18 m. high; branchlets striate, early minutely brown-sericeous-pubescent, becoming gray- or black-pubescent, eventually glabrescent. Leaves alternate, subverticillate; petioles winged, thick, pubescent, 1.5 (–2.5) cm. long; blades early glabrous above, except for the dense and thick ferruginous-sericeous pubescence on the strongly recurved margin and costa beneath, coriaceous, in the dried state brown above or greenish brown, shining, ferruginous-pubescent beneath, opaque, oblong-elliptic, elliptic, or slightly obovate-elliptic, (3–) 7.5–9 (–11) cm. long and (1.8–) 3–4.5 cm. broad, the base cuneate, strongly recurved and decurrent into the petiole, the apex obtuse or slightly and obtusely subacuminate, pinninerved, the costa somewhat elevated above, conspicuously so beneath, pubescent throughout, the nerves 7–10 pairs, plane and regularly slightly elevated, concolorous above, obscure, pubescent beneath, diverging at an angle of 45°, frequently obscure glands present in axils of lateral nerves, the reticulation plane

above and regularly subcancellate, elevated. Inflorescence axillary, narrowly paniculate, subcapitate, to 8 cm. long and 2 cm. broad, few-flowered, stout, densely sericeous-ferruginous-pubescent, the peduncle 3-5 cm. long. Flowers 5.5 mm. long, sessile or pedicellate, the pedicels to 2.5 mm. long, the perianth campanulate (urceolate-campanulate, according to the collector), sulphur-yellow, greenish yellow, or occasionally white, the lobes broadly ovate, acute, thick, densely pubescent, 3-3.5 mm. long; stamens of ser. I & II to 1.9 mm. long, the anthers equaling or twice the length of the filaments; those of ser. III 2.15-2.5 mm. long, the glands sessile, nearly equaling the anthers; gynoecium glabrous, 2.5-3 mm. long, the ovary subglobose or ovoid, more than one-half the entire length, the stigma triangular, conspicuous. Fruit black-olivaceous, minutely canescent or gray-canescence-punctate according to the collector, broadly obovoid, 28-30 \times 20-22 mm., the subtending cupule shallow, red, subcampanulate or at maturity sometimes infundibuliform, somewhat verruculose, glabrous or glabrescent, rugulose, 6-7 cm. long, to 1.5 cm. in diameter and 3 mm. deep, the pedicel glabrous, rugulose, aciculate, to 1 cm. long.

Occurs in cloud-forests or cleared pasture-land of Costa Rica and in rain- and cloud-forests of the adjacent areas of Panama, at an altitude of 1765 to 2300 meters in Costa Rica and up to 1980 meters in Panama. Wood used for lumber. Known as *Sigua Canela*.

CHIRIQUÍ: in rain-forest, Bajo Chorro, Boquete, *Davidson* 268; cloud-forest, Cerro Horqueta, *von Hagen & von Hagen* 2128; Bajo Mona, Robalo Trail, western slope of Cerro Horqueta, *Allen* 4846; vicinity of Cerro Punta, *Allen* 3508 (a robust form, seemingly).

Distinct because of the very prominent and regular, more or less cancellate reticulation of the leaf-blades, the lower surface of which is glaucescent, with sericeous pubescence. These characteristics separate the species from *Ocotea Tonduzii*, *O. Endresiana*, and *O. Skutchii*, its nearest relatives.

12. *OCOTEA RUBRINERVIS* Mez in *Jahrb. Bot. Gart. Berlin* 5:351. 1889.

Tree or shrub 4.5-12 m. high; branchlets dark brown, pubescent becoming glabrous, cinereous, terete. Leaves alternate; petioles pubescent becoming glabrescent, canaliculate, to 1 cm. long; blades scattered, pubescent near the base above, glabrescent beneath except for pubescent axillary glands, subcoriaceous, elliptic or broadly elliptic, to 11 cm. long and up to 7 cm. broad, the base roundish, obtuse or cuneate, the apex shortly obtusely acuminate or obtusely acute, pinninerved, the costa impressed above and prominently elevated and yellowish beneath, the lateral nerves 4-6 pairs, also impressed above and prominently elevated and yellowish beneath, diverging at an angle of about 55°, somewhat reticulate above. Inflorescence axillary or subterminal, paniculate, with narrowly racemose branchlets, to 6-9 (-15) cm. long, glabrescent for the most part, the peduncle very short, occasionally to 3 cm. long. Staminate flowers to 3 mm. long, sessile or with short pedicels to 1 mm. long; perianth yellow, grayish- or ferruginous-pubescent, the lobes ovate, acutish, rather thick, about 2.15-2.5 mm. long; the stamens of ser.

Fig. 21. *Ocotea rubrinervis*

I & II to 1.5 mm. long, the anthers ovate, obtuse to roundish, longer than the filaments; those of ser. III slightly larger, the anthers more narrowly ovate, the filaments completely covered on the dorsal side by the fused sessile glands borne at their bases; staminodia slender, transparent, less than 0.5 mm. long, oblanceolate; gynaecium glabrous, aborted, to 1.9 mm. long, subcylindrical, the stigma subpeltate, depressed above. Pistillate flowers unknown. Fruit green, in the dried state blackish or greenish, ellipsoid, apiculate, rugulose, 11×8 mm., the subtending cupule campanulate, 6-lobed, with the lobes more or less horizontally spreading, somewhat papyraceous, not more than 1.5 mm. long, the entire cupule pubescent or glabrescent, green or red according to the collector, 6–7 mm. long, 8 mm. in diameter, and 2–3 mm. deep, usually sessile.

Described originally from Panama, the locality unknown, and from San Martín, Peru. Now known to occur as far south as Bolivia, at altitudes of less than 1000 meters.

PANAMÁ: San José Island, Perlas Archipelago, Gulf of Panama, Johnston III, 133, 250, 415, 497, 556, 563, 604, 655.

Outstanding among Panamanian species because of the very prominently elevated venation beneath, and the almost spike-like few-flowered panicles.

13. OCOTEA SUBSERICEA Standley in Field Mus. Publ. Bot. 18:456. 1937.

Shrubby tree to 6 m. high; branchlets minutely but densely appressed, yellowish-buff-sericeous-tomentose, angled, becoming grayish, glabrous, terete and striate-sulcate. Leaves alternate; petioles slender, subcanalicate, pubescent, up to 1.5 cm. long; blades early subferruginous-sericeous, quickly glabrescent, thinly membranaceous becoming more thickly membranaceous, elliptic, to 12 cm. long and 4.5 cm. broad, the base cuneate, the apex abruptly and obtusely acuminate, pinnerved, the costa minutely elevated above and conspicuously so beneath, the lateral nerves 6–8 pairs, diverging at an angle of about 45° , and bearing more or less conspicuous axillary glands. Inflorescence axillary, paniculate, to 6.5 cm. long, rather few-flowered, densely but closely pubescent. Flowers (possibly staminate?) to 3 mm. long, the pedicels 2–4 mm. long, the perianth spreading, campanulate, glabrescent, the lobes ovate or oblong, acutish, fleshy and papillose within, about 2.15 mm. long; stamens of ser. I & II 1.25 mm. long, the anthers ovate, truncate, almost equaling the stout filaments; the anthers of ser. III oblong, the filaments covered almost completely by the two conspicuous sessile basal glands; staminodia, if present, very small; gynoecium (either undeveloped or the aborted gynoecium of a staminate flower of a dioecious tree) glabrous, slender, about 2.15 mm. long, the ovary narrow, blending almost imperceptibly into the stout style, the stigma conspicuous, peltate or subtriangular. Fruit black, pointedly ovoid, to 2.5×1.5 cm.

Fig. 22. *Ocotea subsericea*

near the base, the subtending cupule flat, almost disk-like, woody, pale brownish buff, separating, on drying at least, from the fleshy fruit, about 1.5 cm. in diameter and slightly undulate, the enlarged pedicel pale brownish buff, deeply furrowed and verruculose, to 1 cm. long, and 5 mm. in diameter throughout.

Costa Rica and Panama, at an altitude of about 1250 meters.

COCLÉ: north rim of El Valle, *Allen* 1907.

The pointed fruits with the flat almost disk-like woody cupule set apart this species from others of Panama. The nearest relative is *Ocotea eucuneata* from British Honduras and Guatemala, from which it is distinguished by the smaller leaves and smaller thinner cupule. *Allen* No. 3727, collected in bud, north of El Valle de Anton, in the province of Coclé, at an altitude of about 1000 meters, possibly belongs to this species. However, the tree is larger, the branchlets less striate, and the leaves more coriaceous.

14. *OCOTEA CERNUA* (Nees) Mez in *Jahrb. Bot. Gart. Berlin* 5:377. 1889.

Tree or shrub 3.6–6 m. high; branchlets angled or striate, terete, early pubescent, quickly glabrous. Leaves alternate or subopposite; petioles slender, canaliculate, glabrous, up to 12 mm. long; blades glabrous throughout, chartaceous, or subcoriaceous, oblong-elliptic, to 16 cm. long and 6.5 cm. broad, the base, generally speaking, roundish or obtuse, with the extreme portion abruptly cuneate, the apex

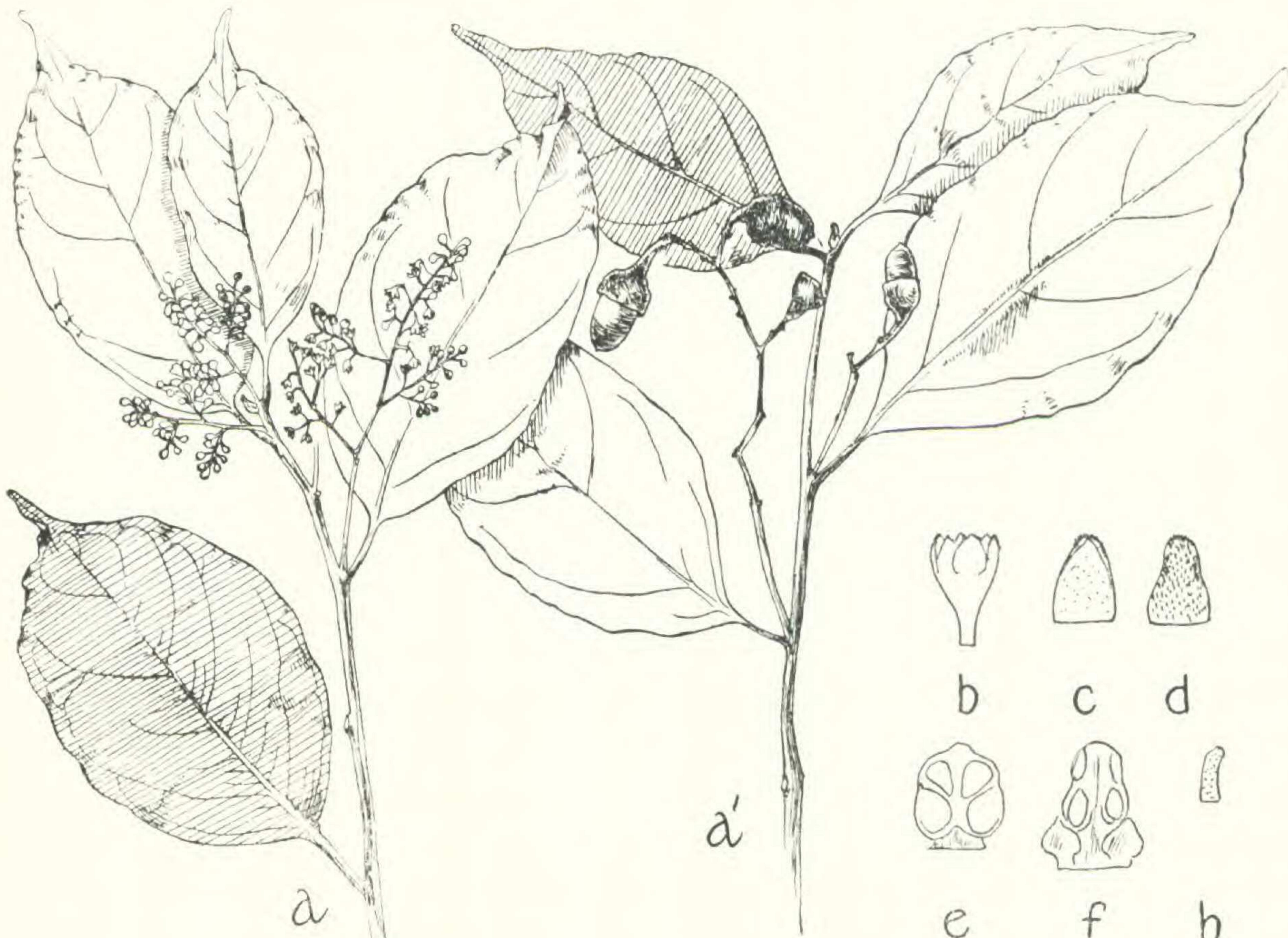


Fig. 23. *Ocotea cernua*

abruptly or gradually acuminate, usually caudate-acuminate, pinninerved, the costa conspicuous above, more prominently elevated beneath, the lateral nerves 4–6 pairs, delicate, obscure above, more prominent beneath, the lowermost pairs usually the longest, and diverging at an angle of about 45° , the reticulation obscure above, less so beneath. Inflorescences numerous, axillary, slender, panicles 4–5 (–7.5) cm. long, branching racemously, many-flowered, glabrous, the peduncle rarely more than 2 cm. long. Staminate flowers small, not more than 2 mm. long, the pedicels slender, filamentous, to 4 mm. long, the perianth-lobes ovate, obtusish or acute, glabrous, (1–) 1.25 (–1.7) mm. long; stamens of ser. I & II 0.8 mm. long, the anthers quadrate or ovate-triangular, obtuse, almost sessile; those of ser. III longer, the anthers more narrowly ovate, the filaments with two basal, compressed, often suborbicular, subsessile glands; gynoecium glabrous, aborted, linear, not more than 0.8 mm. long. Pistillate flowers similar to the staminate; stamens smaller, seemingly sterile; gynoecium glabrous, 1.5 mm. long, the ovary ellipsoid-subglobose, attenuate into an extremely short style, the stigma conspicuous, three-parted. Fruit black, ellipsoid, apiculate, to 14×9 mm., the lower third encased in a more or less snug-fitting hemispherical, somewhat woody cupule 6 mm. long, 11 mm. in diameter, and 3–4 mm. deep, the pedicel to 7 mm. long, expanded to 2 mm. in diameter at the apex.

Southern Mexico, Central America, and the West Indies, and, according to Meissner, in South America. Known as *Sigua*, *Sigua amarillo*.

BOCAS DEL TORO: Changuinola Valley, Cooper & Slater 105 (Y 10286); Island Potrero, Dunlap 568; Water Valley, von Wedel 803. CHIRIQUI: without locality, Cooper & Slater 262 (Y 10615). CANAL ZONE: Hayes 397; Barro Colorado Island, Shannon Trail, Shattuck 535; Drayton Point, Shattuck 1140; shore of cove s. from lock site, Woodworth & Vestal 471. DARIÉN: along the Sambú River, above tide-limit, Pittier 5692.

The only species of the genus in Panama with dioecious flowers. Most nearly related to *Ocotea Bernoulliana*, with perfect flowers, from Guatemala, Honduras, and British Honduras, and to *O. tenera* from Costa Rica, also dioecious, but with fruits larger and subtended by a flat shallow cupule with an undulate margin.

4. NECTANDRA Rollander

NECTANDRA Rollander ex Rottboell in Acta Univ. Hafn. 1:267. 1778.

Evergreen trees or shrubs. Leaves alternate, or occasionally subopposite, the blades pinninerved. Inflorescence axillary and/or subterminal, usually paniculate. Flowers perfect, pedicellate. Perianth-tube conspicuous or lacking. Perianth-lobes usually fleshy and reflexed or spreading at anthesis, usually deciduous. Stamens of the two outer series fleshy, petaloid, papillose and ovate, or quadrate or orbicular with conspicuous connective tissue, or reniform or subreniform, frequently emarginate, with no apparent connective tissue, the cells occupying the entire anther. Anthers sessile or borne on filaments, with four introrse cells usually arranged in an arc-like formation, which only rarely is obscure. Stamens of inner

or third series usually quadrate; in flowers bearing petaloid outer series, the inner also sometimes fleshy and papillose with truncate connectives; in other cases, the inner not fleshy nor papillose and the connectives inconspicuous. Four cells arranged in two horizontal planes; those of the upper plane lateral or laterally extrorse; those of the lower plane usually extrorse. Staminodia when present, for the most part, stipe-like. Gynaecium completely glabrous except in *N. reticulata*; ovary subglobose or ovoid, rarely ellipsoid; style usually short; stigma conspicuous, discoid or subcapitate, triangular or occasionally triangular-peltate, often decurrent. Fruit usually ellipsoid or subglobose, occasionally oblong or obovoid, borne in a cupule with simple margin occasionally bearing remnants of the perianth-lobes, uniformly subtended by enlarged pedicel.

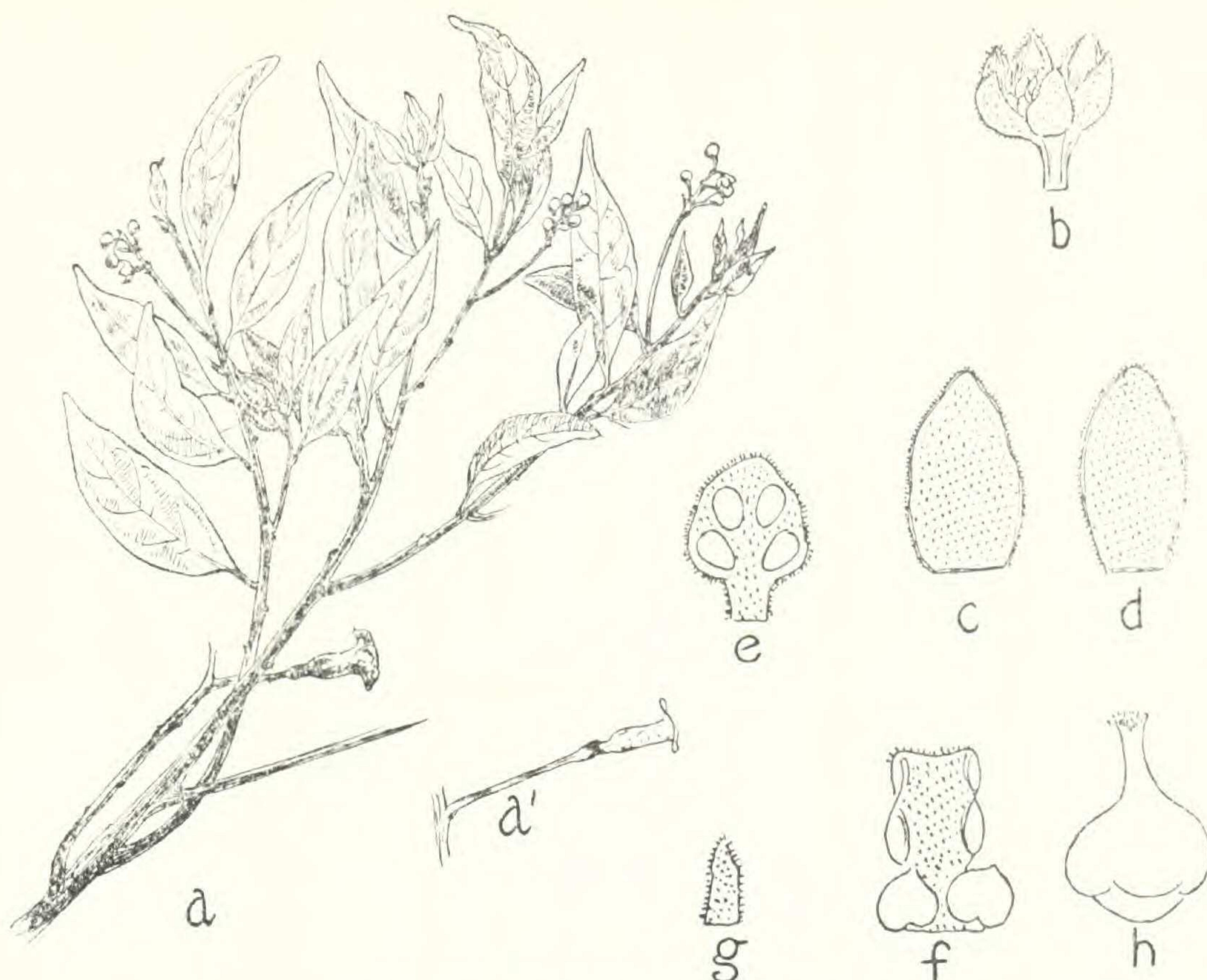
Nectandra consists roughly of 175 recognized species, 125 of which are to be found in South America, about 34 in Mexico and Central America, and the remainder in the West Indies. Good timber for carpentry and general construction locally.

- a. Leaf-blades not recurved at all at the base or decurrent, not auriculate nor cordate nor even rounded at the base generally.
 - b. Largest leaf-blades never more than 8 cm. long.
 - c. Largest leaf-blades up to 7 cm. long and 2.2 cm. broad, lanceolate or elliptic-lanceolate, varnished-shining above, the reticulation somewhat obscure..... 1. *N. DAVIDSONIANA*
 - cc. Largest leaf-blades up to 8 cm. long and 3-4 cm. broad, elliptic, not varnished-shining above, the reticulation very conspicuous..... 2. *N. SMITHII*
 - bb. Largest leaf-blades never less than 9-10 cm. long.
 - c. Anthers of the two outer series of stamens fleshy, petaloid, papillose, never emarginate, the upper third consisting of connective tissue, the remaining space occupied by the cells.
 - d. Leaf-blades pale green, usually with the venation and reticulation showing yellowish, often with large ellipsoid axillary pubescent glands on the lower surface, but conspicuous on both surfaces..... 3. *N. PANAMENSIS*
 - dd. Leaf-blades not pale green with conspicuous whitish venation and reticulation; axillary glands, if present, rather inconspicuous.
 - e. Branchlets, leaf-blades, petioles and inflorescences ferruginous-tomentose or ferruginous-tomentellous.
 - f. Leaves alternate, the blades elliptic or ovate, the base obtuse, coriaceous, densely tomentose beneath..... 4. *N. LAUREL*
 - ff. Leaves opposite usually, the blades lanceolate or elliptic, the base acute, rigidly coriaceous, tomentellous beneath..... 5. *N. RIGIDA*
 - ee. Branchlets, leaf-blades, petioles and inflorescences not ferruginous-tomentose or ferruginous-tomentellous.
 - f. Leaf-blades with lateral nerves 8-12 pairs..... 6. *N. GLOBOSA*
 - ff. Leaf-blades with lateral nerves 4-5 (-7) pairs..... 7. *N. RAMONENSIS*
 - cc. Anthers of the two outer series of stamens not fleshy, petaloid, or papillose, but quadrate or reniform, subreniform or suborbicular, and frequently emarginate, the cells occupying the entire anther.
 - d. Greatest width of leaf-blades at or below the middle, the blade tapering towards the apex only..... 8. *N. GENTLEI*
 - dd. Greatest width of leaf-blades exactly at the middle or the blade tapering towards the base and the apex equally, or the leaf-blades obovate.
 - e. Largest leaf-blades not less than 7 cm. broad..... 9. *N. WOODSONIANA*
 - ee. Largest leaf-blades not more than 6.5 cm. broad, usually less than 5 cm.

- f. Inflorescence usually glabrous; branchlets glabrous or minutely and sparsely pubescent becoming glabrous.
- g. Leaf-blades not caudate-acuminate at the apex.....10. *N. SALICINA*
- gg. Leaf-blades caudate-acuminate at the apex.....11. *N. FUSCOBARBATA*
- ff. Inflorescence variously pubescent; branchlets early densely and minutely golden- or subferruginous-tomentose or sericeous, later becoming glabrescent to glabrous.
- g. Reticulation loose, scarcely apparent on the upper surface of the leaf-blades.....12. *N. NITIDA*
- gg. Reticulation minute, exceedingly prominent throughout..13. *N. LATIFOLIA*
- aa. Leaf-blades recurved at the base and decurrent, or auriculate and recurved, or cordate and recurved.
- b. Base of leaf-blades decurrent and recurved, not auriculate.
- c. Petioles not thickened or lengthened by decurrent leaf-blades; leaf-blades only slightly decurrent at the base and very slightly recurved for less than 5 mm.
- d. Anthers more or less ovate, obtuse, with fleshy, papillose connectives; fruit ellipsoid or globose.
- e. Leaf-blades with lateral nerves 8–12 pairs.....6. *N. GLOBOSA*
- ee. Leaf-blades with lateral nerves 4–6 (–7) pairs.....7. *N. RAMONENSIS*
- dd. Anthers subreniform, subemarginate; fruit usually globose.
- e. Leaf-blades chartaceous, lanceolate, the greatest width at or below the middle, the blade tapering towards the apex only... 8. *N. GENTLEI*
- ee. Leaf-blades coriaceous, elliptic, the greatest width exactly at the middle, the blade tapering towards the base and the apex equally, or rarely obovate.....14. *N. STANDLEYI*
- cc. Petioles variously thickened and seemingly lengthened by decurrent leaf-blades; leaf-blades conspicuously decurrent and recurved at the base up to 4–5 cm.
- d. Largest leaf-blades not more than 3.5 (–4) cm. broad.....15. *N. WHITEI*
- dd. Largest leaf-blades not less than 5 cm. broad, usually more than 6 cm.
- e. Leaf-blades usually shining above, and heavily reticulate; anthers ovate, the connective tissue comprising the upper $\frac{1}{4}$ – $\frac{1}{2}$; stigma borne on a well-defined style; cupule and pedicel to 2.5 cm. long.....16. *N. HYPOGLAUCIA*
- ee. Leaf-blades not shining, inconspicuously reticulate above; anthers subreniform (or depressed-globose), the cells occupying the entire anther; stigma subsessile; cupule and pedicel 1.8 cm. long.....17. *N. PAULII*
- bb. Base of leaf-blades definitely auriculate and recurved, the recurved auricles often overlapping conspicuously beneath.....18. *N. RETICULATA*

1. *NECTANDRA DAVIDSONIANA* C. K. Allen in Jour. Arnold Arb. 26:369. 1945.

Tall tree; branchlets foliose, fulvous-sericeous, quickly glabrescent, the bark actually reddish brown, but obscured by a thin grayish epidermis that is deciduous. Leaves alternate; petioles slender, canaliculate, to 8 mm. long; blades glabrous throughout, membranaceous, varnished-shining above in dried state, greenish or brown, paler beneath, lanceolate or elliptic-lanceolate, 5–6 (–7) cm. long and 13–17 (–22) mm. broad, the base cuneate, the apex obtuse or obtusely acuminate, pinninerved, the costa inconspicuous above, slightly elevated beneath, the lateral nerves usually 4 pairs, obscure above, slightly elevated beneath, diverging from the costa at an angle of 35–45°, the reticulation inconspicuous above, scarcely conspicuous beneath. Inflorescence axillary, paniculate, small, 2 (–4) cm. long, slender, inconspicuous, glabrous, very few-flowered (to 5), the peduncle slender, glabrous, to 2 (–2.5) mm. long. Flowers to 4 mm. long, the pedicels slender, often up to 3 mm. long, the perianth campanulate, cream-colored, the subequal

Fig. 24. *Nectandra Davidsoniana*

lobes membranaceous, papillose, elliptic, 2.8 mm. long; stamens of ser. I & II to 1 mm. long, the anthers oblong-globose, three times the length of the slender filaments; those of ser. III 1.25 mm. long, the anthers oblong, the glands short-stipited, sometimes equaling the anthers and filaments; staminodia strap-shaped or triangular, inconspicuous, 6 mm. long; the gynaecium glabrous, 1.5 mm. long, the ovary ovoid or subglobose, three times longer than the stipe and twice the length of the style, the stigma triangular-discoid, conspicuous. Fruit unknown, black according to the collector, the cupule hypocrateriform, disk-like, red according to the collector, glabrous, 1 cm. in diameter, the pedicel subverruculose, to 1 cm. long and 4 mm. in diameter throughout, the margin entire, slightly undulate.

Known only from the type locality in Chiriquí, at 1830 meters altitude.

CHIRIQUÍ: Boquete, *Davidson* 564.

In general aspect resembling *Nectandra salicifolia* from Mexico and northern Central America, but differing in the shape of the anthers, and in the smaller leaves.

2. *NECTANDRA SMITHII* C. K. Allen in Jour. Arnold Arb. 26:370. 1945.

Tree 10–17 m. high; branchlets foliose, minutely subferruginous-pubescent, gray, striate, verruculose. Leaves alternate; petioles slender, glabrescent, canaliculate, (5–) 7–10 (–12) mm. long; blades glabrous throughout, except the venation at the base of the costa, membranaceous, brown throughout in the dried state,

somewhat shining above, elliptic, 6–8 cm. long and 3–4 cm. broad, the base cuneate, rarely obtuse, the apex acute or shortly subcaudate-acuminate, pinnerved, the costa pubescent throughout, conspicuously elevated beneath, the nerves 5 pairs, slightly prominent above, strongly so beneath, diverging at an angle of 35–45°, the axillary glands conspicuous, usually fulvous-pubescent, the reticulation very conspicuous throughout. Inflorescence axillary, paniculate, short, 2–3 (–5.5) cm. long, glabrescent, few-flowered, the peduncle slender, 1–2 cm. long. Flowers to 3.5 mm. long, the pedicels slender, 1.5–2 (–8) mm. long, the perianth subcampanulate, white (?) or cream, the lobes oblong, obtuse, fleshy, papillose-



Fig. 25. *Nectandra Smithii*

tomentose, 2.5–3 mm. long; stamens of ser. I & II 0.8 mm. long, the anthers subreniform, at least twice the length of the filaments; those of ser. III 1.25 mm. long, the anthers equaling the filaments and glands; staminodia oblanceolate, acute, 0.5 mm. long; gynoecium glabrous, 1.7 mm. long, the ovary broadly ovoid, the style short, robust, the stigma triangular. Fruit black, subglobose, minutely apiculate, to 1 cm. in diameter, the subtending cupule shallow, tumescent, to 4 mm. long, 6 mm. in diameter and 2 mm. deep, the pedicel 4–5 mm. long, expanded to 3 mm. in diameter at the apex.

Costa Rica, in the Caribbean cloud-forest at 1600–1700 meters altitude and in Panama from 100 to 800 meters.

COCLÉ: vicinity of El Valle, *Allen* 774, 3534. PANAMÁ: residual forest in rolling grassland, trail from Campana to Chica, Cerro Campana, *Allen* 2652.

Also reminiscent of *Nectandra salicifolia*, but distinguished by the very foliose branchlets, the consistently few pairs of lateral nerves, the prominent reticulation of the small leaves, and the bulging cupule which fits snugly about the very base of the fruit.

3. *NECTANDRA PANAMENSIS* Mez in Jahrb. Bot. Gart. Berlin 5:443. 1889.

Tree to 20 m. or more (or shrub); branchlets glabrous with only a trace of



Fig. 26. *Nectandra panamensis*

pubescence at the apex, greenish becoming brownish, angled becoming terete and striate. Leaves alternate; petioles glabrous, up to 1 cm. long; blades glabrous, membranaceous or chartaceous, pale greenish in the dried state, narrowly elliptic or elliptic-lanceolate, 15 (-20) cm. long and 3.5 (-5.5) cm. broad, the base cuneate, the apex acutish or sub acuminate or often obtusely long-acuminate, pinnerved, the costa plane and conspicuous above because of its yellowish color, elevated beneath, the nerves 5-7 (-9) pairs, yellowish and slightly elevated above, but more conspicuously so beneath, diverging from the costa at an angle of 25-35 (-45)°, usually with very prominent large ellipsoid pubescent glands beneath, the imprint of which is conspicuous on the upper surface of the blade. Inflorescence axillary or subterminal, paniculate, 12 (-19) cm. long, much-branched near

the base, peduncle very short. Flowers 3.5–4 mm. long and up to 8 mm. in diameter, the pedicel slender, to 4 (–16) mm. long, the perianth white, pubescent, the lobes fleshy, pubescent, up to 3 mm. long; stamens of ser. I & II 0.8 mm. long, the anthers broadly ovate, obtuse or somewhat depressed-globose, the fleshy, papillose connective tissue apparent, the filaments very short and thick; those of ser. III to 1.25 mm. long, the anthers subrectangular, broader than long, the filaments rather stout, the glands conspicuous, sessile, almost larger than the anthers; staminodia very thin, almost scale-like, or ovate, pubescent, to 6 mm. long, the stipe about half the entire length; gynoecium glabrous, 1.7 mm. long, the ovary ellipsoid or subglobose, the style very short, stout, the stigma triangular, conspicuous. Fruit (immature?), with the subtending cupule cyathiform, to 6 mm. long, 9 mm. in diameter, and 4 mm. deep, the pedicel up to 5 mm. long, and scarcely broader at the apex than at the base.

Panama, from 30 to 100 meters altitude.

CANAL ZONE: near Gorgona and Maumé, Wagner, s. n.; Darién, MacBride 2703. PANAMÁ: forests on dry limestone, around Alhajuela, Chagres Valley, Pittier 2398; vicinity of Pacora, Allen 1126, 2033.

Rather near *Nectandra Gentlei*, a widespread species in Central America, but separated by the narrowly elliptic or elliptic-lanceolate leaf-blades and the yellowish lateral nerves diverging from the costa at an angle of 25–35 (–45)° and usually bearing large ellipsoid pubescent axillary glands on the lower surface.

4. *NECTANDRA LAUREL* Klotzsch & Karsten ex Nees, in Linnaea 21:505. 1848.

Tree to 16 m. high; branchlets thick, densely ferruginous-tomentose becoming grayish, somewhat angled. Leaves alternate, occasionally near the tips of the branchlets becoming opposite or subopposite; petioles 1.5 (–2.5) cm. long; blades usually ferruginous-tomentose throughout, quickly becoming glabrous above except for venation, greenish brown when dried, coriaceous, elliptic or ovate, (6–) 10–15 (–35) cm. long and 3–6 (–15) cm. broad, the base obtuse usually, the apex obscurely or sharply acuminate, the acumen often to 2.5 cm. long, pinninerved, ferruginous-pubescent throughout, impressed above, elevated beneath, the nerves 7–9 (–14) pairs, impressed above, elevated beneath, diverging from the costa at an angle of 35–45°, the transverse venation impressed above, prominent beneath. Inflorescence axillary or often subterminal, paniculate, 8 (–20) cm. long, densely ferruginous-tomentose, few- to many-flowered, the peduncles 5–7 cm. long. Flowers to 15 mm. in diameter, fragrant, the pedicels to 2 mm. long, the perianth white, pubescent, the lobes fleshy, pubescent, (5–) 7 mm. long; stamens of ser. I & II 1.7 mm. long, the anthers broadly ovate, obtuse, the connective tissue papillose, the filaments short and comparatively slender, those of ser. III to 1.7 mm. long, the filaments conspicuously biglandular; staminodia 0.3 mm. long; gynoecium glabrous, 2.3 mm. long, the ovary ovoid or obovoid, slightly larger than the style, the stigma obtuse, discoid. Fruit ellipsoid, smooth, to 12 mm. long

and 8 mm. in diameter; the cupule hemispherical, about $\frac{1}{4}$ the length of the entire fruit.

Andes of Peru as far north as Panama.

CANAL ZONE: without exact locality, *Hayes 1047*.

This species has two close relatives. The first is *Nectandra rigida*, from which it may be distinguished (See Kostermans in Meded. Bot. Mus. Utrecht 25:29. 1936) by its usually alternate leaves, which are elliptic or ovate, with an obtuse base, and are coriaceous with the nerves conspicuously impressed above. The leaves of *N. rigida*, however, are usually opposite, at least the upper ones, lanceolate, with acute bases, and rigidly coriaceous. The second affinity is seen in *N. reticulata*, which is at once distinguished by the presence of a basal auricle with reflexed margins. Kostermans (l. c.) has noted, also, the glabrous inner surface of the tube of *N. rigida*, as opposed to the densely sericeous hirsute tube of *N. reticulata*.

5. *NECTANDRA RIGIDA* Nees, Syst. Laurin. 284. 1836.

Shrub or medium-sized branching tree, to 15 m. high; branchlets densely ferruginous-tomentellous becoming glabrous, somewhat angled. Leaves opposite usually, at least the upper ones; petioles stout, ferruginous-tomentellous, becoming grayish, up to 2 cm. long; blades more or less glabrous at maturity, brown, shining above, pubescent and paler beneath, elliptic or lanceolate, 12–25 cm. long and 3.5 cm. broad, the base acute, occasionally obtusish, the apex acuminate, pinninerved, the costa slightly elevated above, glabrous except at the base, conspicuously elevated beneath and pubescent, the nerves usually 8–10 pairs, rather inconspicuous above, elevated and pubescent beneath, arcuate, diverging from the costa at an angle of 45–55° (–75°), the transverse venation conspicuous beneath and pubescent. Inflorescence subterminal, axillary, paniculate, less than 5 cm. long, densely ferruginous-pubescent, many-flowered, the peduncle short. Flowers 9–10 (–14) mm. in diameter, the perianth white, ferruginous-tomentose without, the lobes broadly elliptic; stamens of ser. I & II 1.8 mm. long, sessile, the anthers ovate, the connective tissue papillose, those of ser. III 2 mm. long, conspicuously biglandular; staminodia small; gynoecium 2.3 mm. long, the ovary ovoid, slightly shorter than the style, the stigma triangular-discoid. Fruit ellipsoid, to 15 mm. long and 10 mm. in diameter, the cupule hemispherical, rugulose, less than $\frac{1}{4}$ the length of the entire fruit.

Tropical America from Panama to Brazil.

CANAL ZONE: Mindi, *Hayes 615*; in woods near Gatún, *Hayes 916*.

For discussion of relationships see the preceding species.

6. *NECTANDRA GLOBOSA* (Aublet) Mez in Jahrb. Bot. Gart. Berlin 5:415. 1889, excl. syn.

Laurus globosa Aubl. Pl. Guian. 1:364. 1775.

Tree 4.5–15 m., or shrub 3–6 m. high; branchlets closely and minutely sub-

ferruginous-pubescent, in the early stages angled and flattened at the nodes, later becoming reddish brown, striate, and glabrous. Leaves alternate; petioles stout, minutely pubescent to glabrous, canaliculate, to 1.5 cm. long; blades early minutely pubescent, becoming glabrescent to glabrous, coriaceous, usually shining above, dull beneath, elliptic to oblong-elliptic, 14–16 (–24) cm. long and 4–5 (–10) cm. broad, the base rounded or sharply cuneate, the latter appearance due to the lower half centimeter or so of the leaf-blade being recurved, the apex long-acuminate, pinninerved, the costa slightly impressed above, rather conspicuous and elevated beneath, the nerves 8–12 pairs, inconspicuous above and elevated beneath, diverging from the costa at an angle of 30–45°, axillary pubescent glands frequently present, the reticulation obscure. Inflorescence axillary, rarely subterminal, paniculate, to 12–15 (–20) cm. long, minutely subferruginous-pubescent to glabrescent, many-flowered, stout, usually wide-branching, the peduncle variable, from extremely short to 8 cm. long. Flowers large and conspicuous, white, to 12 mm. in diameter, the perianth-lobes elliptic or obovate-elliptic, acutish or obtuse, the inner often more narrow than the outer, reflexed, very fleshy, papillose within, pubescent without, 4–5 mm. long; stamens of ser. I & II 1.25 (–1.5) mm. long, the anthers sessile or subsessile, rounded or broadly rounded-ovate, the fleshy papillose connective often one-third the entire length; those of ser. III to 1.7 mm. long, the anthers broad, narrowing slightly into the thick filaments almost one-

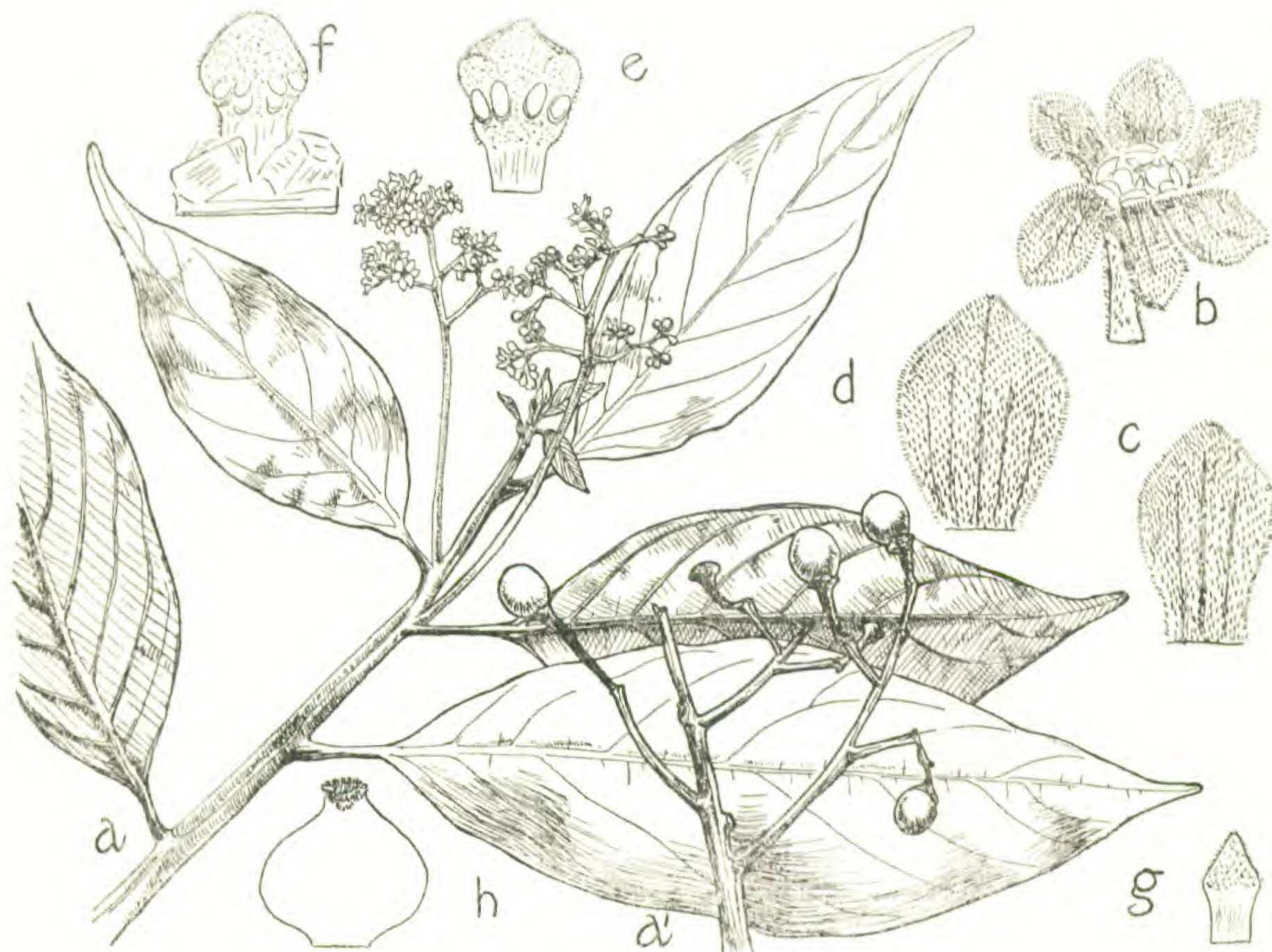


Fig. 27. *Nectandra globosa*

half their length, the glands conspicuous, spreading, sessile, almost the length of the anthers; staminodia triquetrous, to 1 mm. long, the thick stipe nearly one-half the entire length; gynaecium glabrous, to 1.7 mm. long, the ovary subglobose, two-thirds the entire length, the style short, the stigma subsessile, triangular-discoid or occasionally obtuse. Fruit globose, apiculate, about 1 cm. in diameter, the subtending cupule very shallow, up to 2 mm. long, 8 mm. in diameter and 2 mm. deep, the margin usually entire and thin, the pedicel to 5 mm. long, expanded to 3 mm. in diameter at the apex.

Widespread through the tropics of America, from the West Indies, Mexico and Central America, at varying altitudes. In Panama usually 10 to 100 meters along the coast; from 600 to 900 meters farther inland in the mountains. Known as "Sweetwood," *Sigua*.

BOCAS DEL TORO: Changuinola Valley, *Dunlap* 215, *Cooper & Slater* 86 (Y 10267). CHIRIQUÍ: San Felix, *Pittier* 5145. COCLÉ: above Penonomé, *Williams* 257, 319, 530. CANAL ZONE: without locality, *Hayes* 1021, 1037, 1038; Gatún Lake, near laboratory, *Wetmore & Abbe* 17, 43, *Woodworth & Vestal* 314; alluvial bottom near Bohio, *Maxon* 4772; vicinity of Miraflores Lake, *G. White* 191, *P. White* 276; between Miraflores and Corozal, *Pittier* 2495; near lake, vicinity of Cocolí River, *P. White* 95; Barro Colorado Island, *Brown* 40, 68, 72, 188, *Shattuck* 314, 458, 807, *Wilson* 2; along Río Fató, in forests or thickets, *Pittier* 3873. PANAMÁ: vicinity of Arraijan, *Allen* 1622; Chepo, *Kluge* 27. DARIÉN: Chepigana, Tucuti, *Terry & Terry* 1391.

This widespread species is very distinct, because of the large coriaceous leaves with obscure reticulation, the venation very prominent beneath, the base of the blade recurved for about a half-centimeter or so, and the large conspicuous white flowers developing into globose fruit.

7. *NECTANDRA RAMONENSIS* Standley in Field Mus. Publ. Bot. 18:453. 1937.

Tree 6–15 m. high; branchlets closely and minutely subferruginous-pubescent becoming grayish, outer cortex sometimes flaking off to reveal a dark reddish brown color. Leaves alternate; petioles short, slender, pubescent, less than 1 cm. long; blades sericeous beneath becoming minutely pubescent, often shining above, dull beneath, elliptic, occasionally oblong-elliptic, 7–11.5 cm. long and 2.5–6 cm. broad, the base obtuse and/or the lowermost portion attenuately cuneate, frequently recurved and almost decurrent, the apex obtuse to acutish or acuminate, pinninerved, the costa slightly impressed above and somewhat obscure and slightly elevated beneath, the nerves not more than 4 or 5 (–7) pairs, slightly impressed above and somewhat obscure and slightly elevated beneath, diverging from the costa at an angle of 35–45°, the axillary glands pubescent. Inflorescence axillary or subterminal, paniculate, to 8 cm. long, comparatively few-flowered, minutely subferruginous-sericeous-tomentellous, the long peduncles stout, frequently up to 6 cm. long. Flowers large and conspicuous, to 15 mm. in diameter, the perianth-lobes elliptic or obovate-elliptic, acutish or obtuse, reflexed, very fleshy, papillose

Fig. 28. *Nectandra ramonensis*

within, pubescent without, 4–5 mm. long; stamens of ser. I & II 1.25 (–1.5) mm. long, the anthers sessile or subsessile, rounded or broadly rounded-ovate, the fleshy papillose connective often one-third the entire length; those of ser. III 1.7 mm. long, the anthers broad, narrowing slightly into the thick filaments almost one-half their length, glands conspicuous, spreading, sessile, almost the length of the anthers; staminodia triquetrous, to 1 mm. long, the thick stipe nearly one-half the entire length; gynaecium glabrous, 1.7 mm. long, the ovary subglobose, two-thirds the entire length, the style short, the stigma triangular, discoid or obtuse, frequently decurrent. Fruit ellipsoid, 1.5 × 9 mm., the subtending cupule 4–5 mm. long, 8–10 mm. in diameter and 2–3 mm. deep, the pedicel about 5 mm. long, and 3–4 mm. in diameter at the apex.

Costa Rica and adjacent Panama, at an altitude of 600 to 1140 meters.

CHIRIQUÍ: Boquete, Davidson 566. COCLÉ: vicinity of El Valle, Allen 1635; north rim of El Valle, Alston 1858.

Very close to *Nectandra globosa*, but with smaller leaves, the inflorescence fewer-flowered, and the fruits ellipsoid.

8. NECTANDRA GENTLEI Lundell in Contr. Univ. Mich. Herb. 6:13. 1941.

Tree? 3–20 m. high; branchlets closely and shortly subtomentellous-pubescent, becoming pale ferruginous or brownish, presently fuscous, and eventually glabrescent to glabrous, dark reddish brown and striate. Leaves alternate or occasionally

Fig. 29. *Nectandra Gentlei*

subopposite; petioles canaliculate, brown-tomentellous, to 1.5 cm. long; blades early sericeous throughout, soon becoming glabrescent to glabrous above, remaining shortly but persistently pubescent beneath, chartaceous, lanceolate, to 20 cm. long and to 4.5 (–5) cm. broad, the broadest part of the blade being at or below the middle, the base seemingly cuneate, actually rounded or even subauriculate, the extreme bases usually tightly recurved, the apex attenuate into a slender acumen which may or may not be caudate, pinninerved, the costa slightly impressed and rather inconspicuous above, prominently elevated beneath, the lateral nerves 4–6 pairs, occasionally 7 or 8, slightly impressed and rather inconspicuous above, prominently elevated beneath, diverging from the costa at an angle of about 45° , at a distance of about 1–1.5 cm. from their origin ascending abruptly to follow the outline of the leaf-blade almost parallel with the midrib. Inflorescence axillary, paniculate, to 8 (–12) cm. long, subferruginous- or brown-tomentellous becoming glabrescent, the peduncle (2–) 4 (–6) cm. long. Flowers to 3 mm. long and 5.5 mm. in diameter, the perianth yellow or white, sometimes fragrant, the tube well defined, constricted at the apex, and about 1 mm. long; the lobes usually elliptic, rather thick and papillose at the tip, 1.7 (–2.15) mm. long; stamens of ser. I & II 0.6–0.8 mm. long, the anthers subreniform-globose, almost sessile; those of ser. III 0.8 (–1.25) mm. long, the anthers almost square, slightly emarginate, the large conspicuous basal glands frequently contiguous; staminodia variable,

lanceolate, oblanceolate, or even ovate, slender, stipitate, often pubescent; gynoecium glabrous, 1.7 mm. or less long, the ovary ovoid, slightly shorter than the style, the stigma conspicuous, triangular, slightly decurrent. Fruit black at maturity, subglobose, about 8 mm. in diameter (or elliptic, $9 \times 6-7$ mm.), the subtending cupule thin, shallow, not more than 3 mm. long, 6 mm. in diameter, and usually less than 2 mm. deep, glabrous, with an entire margin, the pedicel less than 5 mm. long and expanded at the apex to about 2 mm. in diameter.

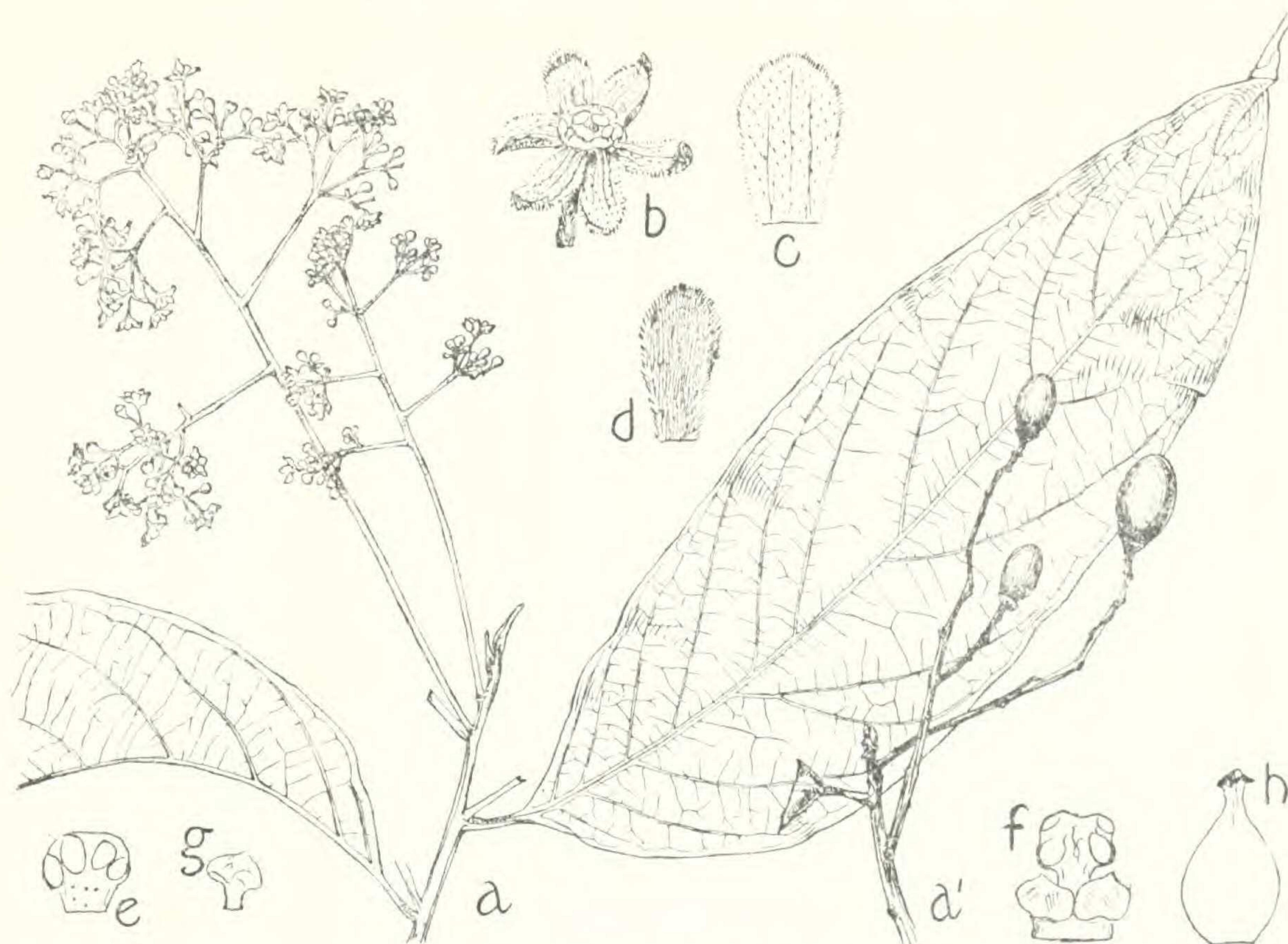
Southern Mexico through Guatemala, Honduras, and British Honduras to Panama, at low altitudes for the most part, although possibly it occurs as high as 900 and 2000 meters in Coclé and Darién.

CHIRIQUÍ: El Pedregal de David, Pittier 5117; vicinity of San Felix, Allen 3650. COCLÉ: Bismark, above Penonomé, Williams 617. CANAL ZONE: vicinity of Miraflores Lake, P. White 243; Ancon Hill, Killip 3032, Standley 26376; near Quarantine Station, Pittier 2076; hospital grounds at Ancon, Pittier 2733; between Corozal and Ancon, Pittier 2639; Balboa, hillside, west of Canal, Rowlee & Stork 987. PANAMÁ: San José Island, Perlas Archipelago, Gulf of Panama, Johnston 82, 221, 270, 521, 699, 716. DARIÉN: Cana and vicinity, Williams 797.

Distinctive because of the narrow lanceolate leaf-blades, with the extreme bases recurved, and the apices attenuate into a slender acumen which may or may not be caudate. Very near *Nectandra Picburim* from South America, but differs in a more shallow cupule. Similar also to the South American *N. cuspidata*, but separable on foliage as well as floral characters.

9. *NECTANDRA WOODSONIANA* C. K. Allen in Jour. Arnold Arb. 26:380. 1945.

Tree 7–15 m. high; branchlets shortly appressed fulvous-tomentellous, becoming glabrescent, brunnescence, finally angled, striate, glabrous, gray. Leaves alternate; petioles more or less blackish, canaliculate, pubescent or glabrescent, to 1.5 (–2) mm. long; blades glabrescent or glabrous, except for axillary glands, in the dried state gray-green, elliptic or oblong-elliptic, to 24 cm. long and 8 cm. broad, the base cuneate, the apex obtuse, acute or acuminate, pinninerved, the costa conspicuous above and slightly impressed, beneath elevated, the nerves 7 or 8 (–10) pairs, slightly elevated above, strongly beneath, diverging from the costa at an angle of about $35-45^\circ$, the reticulation conspicuously elevated throughout. Inflorescence axillary or subterminal, paniculate, to 20 cm. long, densely and appressed gray-pubescent becoming glabrescent, many-flowered, the peduncle to 10 cm. long. Flowers to 3 mm. long, the pedicels 2–3 mm. long, pubescent, the perianth white, the lobes thick, fleshy, papillose within, pubescent without, elliptic or ovate or narrowly obovate, to 2.5 mm. long; stamens of ser. I & II 0.6–0.8 mm. long, the anthers subreniform, twice the length of the stout filaments; those of ser. III 0.9–1.25 mm. long, the anthers quadrate, equaling the filaments; staminodia ovate, obtuse or subtriquetrous, 0.5 mm. long, the stout stipe nearly one-half the entire length; gynoecium glabrous, to 1.7 mm. long, the ovary ovoid, equaling three-quarters the entire length, the style short, the stigma triangular-discoid, conspicuous. Fruit reddish black in the dried state, ellipsoid, to 16×11 mm.,

Fig. 30. *Nectandra Woodsoniana*

the subtending cupule shallow, discoid, ligneous, glabrous or glabrescent, rugulose, to 2 mm. long, 5–6 mm. in diameter, and 1 mm. deep, the enlarged pedicel striate, glabrescent, to 2 mm. long.

El Salvador, Costa Rica, at 1800 meters altitude, south at successively lower altitudes, finally occurring in Central Panama as low as 20 to 90 meters.

CANAL ZONE: Mamei Hill, Pittier 3803; vicinity of Salamanca Hydrographic Station, Río Pequení, Woodson, Allen & Seibert 1620. DARIÉN: Río Chico, vicinity of Yaviza, Allen 4850.

The species at once attracts attention because of the gray-green foliage and long grayish-pubescent inflorescence. Similar to *Nectandra martinicensis* from the West Indies, but the leaf-blades of the latter are smaller, and the margins recurved. Floral differences are apparent also.

10. *NECTANDRA SALICINA* C. K. Allen in Jour. Arnold Arb. 26:385. 1945.

Tree 5–8 m. high; branches densely foliose, gray, sulcate, glabrous; branchlets brown, presently gray, striate, angled. Leaves alternate; petioles slightly winged, slender, glabrous, canaliculate, 5–10 mm. long; blades glabrous throughout, shining above, less so beneath, coriaceous, in the dried state green or sometimes brown, slightly paler beneath, lanceolate, to 10 (–11) cm. long and 2–2.5 (–3.4) cm. broad, the base attenuately cuneate, the apex acute or attenuately acuminate, often attenuately obtusely acuminate, pinninerved, the costa obscure above, conspicuously elevated beneath, the nerves 6 or 7 pairs, rather obscure throughout, diverging

Fig. 31. *Nectandra salicina*

from the costa at an angle of 25–35°, the reticulation sometimes conspicuous throughout, sometimes inconspicuous above. Inflorescence axillary, paniculate, 8–9 (–12) cm. long, glabrous, few-flowered, slender, the peduncle glabrous, 6–8 cm. long. Flowers to 3 mm. long, the pedicels slender, to 5 mm. long, the perianth shallowly subcampanulate, white (or sometimes pinkish or yellowish), the lobes oblong, recurved, thick, densely papillose-tomentose within and at the apex without, to 3 mm. long; stamens of ser. I & II 0.9 mm. long and broad, the anthers subreniform, frequently twice the length of the pubescent filaments, those of ser. III to 1.25 mm. long, the glands almost equaling the anthers; staminodia conspicuous, triangular or ovate, stipitate, 0.6 mm. or more long; gynaecium glabrous, 1.5 mm. long, the ovary subglobose, twice the length of the style, the stigma frequently triangular, conspicuous. Fruit green according to the collector, subglobose, apiculate, 20 × 18 mm., the subtending cupule red, minutely verruculose according to the collector, glabrous, to 6 mm. long, 10–12 mm. in diameter, and 2–3 mm. deep, the margin undulate, the pedicel enlarged, glabrous in the dried state, aciculate, to 1 cm. long.

Found at varying altitudes in Costa Rica, 850 to 1000 meters in Alajuela, 500 to 600 meters in Guanacaste, and in the cloud-forests of Panama, at 1980 meters. Known there as *Sigua blanca*, and used as firewood.

CHIRIQUI: Cerro Horqueta, Boquete, von Hagen & von Hagen 2118.

As far as may be ascertained from the description of the latter, *Nectandra salicina* is related to *N. nervosa*, but may be separated by the smaller leaves, shining above with usually conspicuous reticulation, the paniculate inflorescence, the sub-globose, smaller fruits.

11. *NECTANDRA FUSCOBARBATA* (Mez) C. K. Allen in Jour. Arnold Arb. 26:390. 1945.

Nectandra glabrescens var. *fuscobarbata* Mez in Jahrb. Bot. Gart. Berlin 5:425. 1889.

Tree 6–12 m. high; branchlets brown, minutely sparsely pubescent, becoming gray, glabrous, striate. Leaves alternate, early sparsely pubescent becoming glabrescent and finally glabrous; petioles slender, canaliculate, sparsely pubescent above, to 1 cm. long; blades glabrous throughout except at the base of the costa beneath, membranaceous, in the dried state brown or greenish brown, lanceolate-elliptic, to 15 cm. long and 5 cm. broad, the base very attenuately cuneate, the apex longly caudate-acuminate, pinninerved, the costa slightly elevated above, conspicuously so beneath, the nerves 4 or 5 (–8) pairs, more or less obscure throughout, diverging from the costa at an angle of 55°, the glands inconspicuous, the reticulation slightly prominulous throughout. Inflorescence axillary, loosely paniculate, to 15 cm. long, sparsely pubescent, the peduncle brown, sparsely pubescent, to 5 cm. long. Flowers to 3 mm. long, the slender pubescent pedicels



Fig. 32. *Nectandra fuscobarbata*

to 3 mm. long, the perianth campanulate, white or pale greenish, the lobes reflexed, papillose-pubescent, oblong, 2.5 mm. long; stamens of ser. I & II 0.6 mm. long, the anthers subreniform, two-thirds the length of the slender filaments which are pubescent at the base; those of ser. III 1 mm. long, the anthers oblong, equaling the filaments, the glands conspicuous, stipitate; staminodia usually ovate, stipitate, pubescent at the base, 0.6 mm. long; gynoecium glabrous, 1.25 mm. long, the ovary ovoid-globose, the style very short, the stigma capitate, conspicuous. Fruit abnormal (?), subglobose, apiculate, conspicuously gray-sericeous, minutely papillose, 7 mm. in diameter, subtending cupule shallow, glabrous, minutely verruculose, subcampanulate, 3 mm. long and 5 mm. in diameter, the pedicel to 5 mm. long, expanded to 3 mm. in diameter at the apex.

Described originally from the Isthmus of Panama, and found subsequently only in Panama along the coast at fairly low altitudes. Known as "Rock Sweetwood," and said to have a faint pleasant odor when fresh.

BOCAS DEL TORO: Fish Creek Hill, vicinity of Chiriquí Lagoon, *von Wedel* 2431; Isla Colon, *von Wedel* 2866, 2969; Flat Rock, region of Almirante, *Cooper* 551 (Y 12184).

Seemingly a cognate of *Nectandra salicifolia*, which does not occur in Panama, with similar floral structure except for pubescence of filament-bases and stipes of staminodia. More extensive collections may show that this is a geographical variation of the species proper.

12. *NECTANDRA NITIDA* Mez in *Jahrb. Bot. Gart. Berlin* 5:461. 1889.

Tree 13–15 m. high; young branchlets densely golden—"glittering"—tomentose, becoming gray, glabrous, terete. Leaves sparse; petioles canaliculate, to 6 mm. long; blades early sericeous-lanuginose, golden—"glittering" throughout, later glabrous throughout, chartaceous, varnished-shining above, opaque or subopaque beneath, ovate or elliptic, 12.5 cm. long and 5.5 cm. broad, the base acute, the apex acuminate, the margin minutely recurved, pinninerved, the nerves immersed above, beneath prominently elevated, diverging from the costa at an angle of 25–45°, the reticulation very obscure and loose. Inflorescence subcorymbose, paniculate, shorter than the leaves, rather many-flowered, tomentose, the pedicels 2–5 mm. long, the bracteoles deciduous. Flowers to 5 mm. in diameter, the perianth yellow-tomentose, the lobes broadly elliptic-ovate, somewhat obtusely acute; anthers depressed, broader than long, the apex broadly truncate; the filaments of ser. I & II pilose; those of ser. III with large, conspicuous, sessile glands; staminodia small, thick, stipe-like; ovary glabrous, globose, 3–4 times shorter than the style; stigma obtuse. Fruit subglobose, 6 mm. long, mucronulate, with the rudiment of the style, the subtending cupule pateriform, smooth at the base, the margin entire, the pedicel one-third to one-quarter the entire length.

Reported from western Mexico at an unknown locality from the Haenke collection; and in Panama near Barbacans Station, S. Hayes 133.

Except for the original description, this species is unknown, or at least uncommented upon, by present-day workers in the family. It seems to be very close to

Nectandra latifolia, differing in leaf-blades that are prominently reticulated above and in the young stage scarcely sericeous beneath, the absence of axillary glands, branchlets that are sparkling "golden-tomentose," and buds that are golden-lanuginose. Authentic material is essential for further study.

13. *NECTANDRA LATIFOLIA* (H.B.K.) Mez in Jahrb. Bot. Gart. Berlin 5:454. 1889.

Ocotea latifolia H.B.K. Nov. Gen. & Sp. 2:133 [169]. 1817.

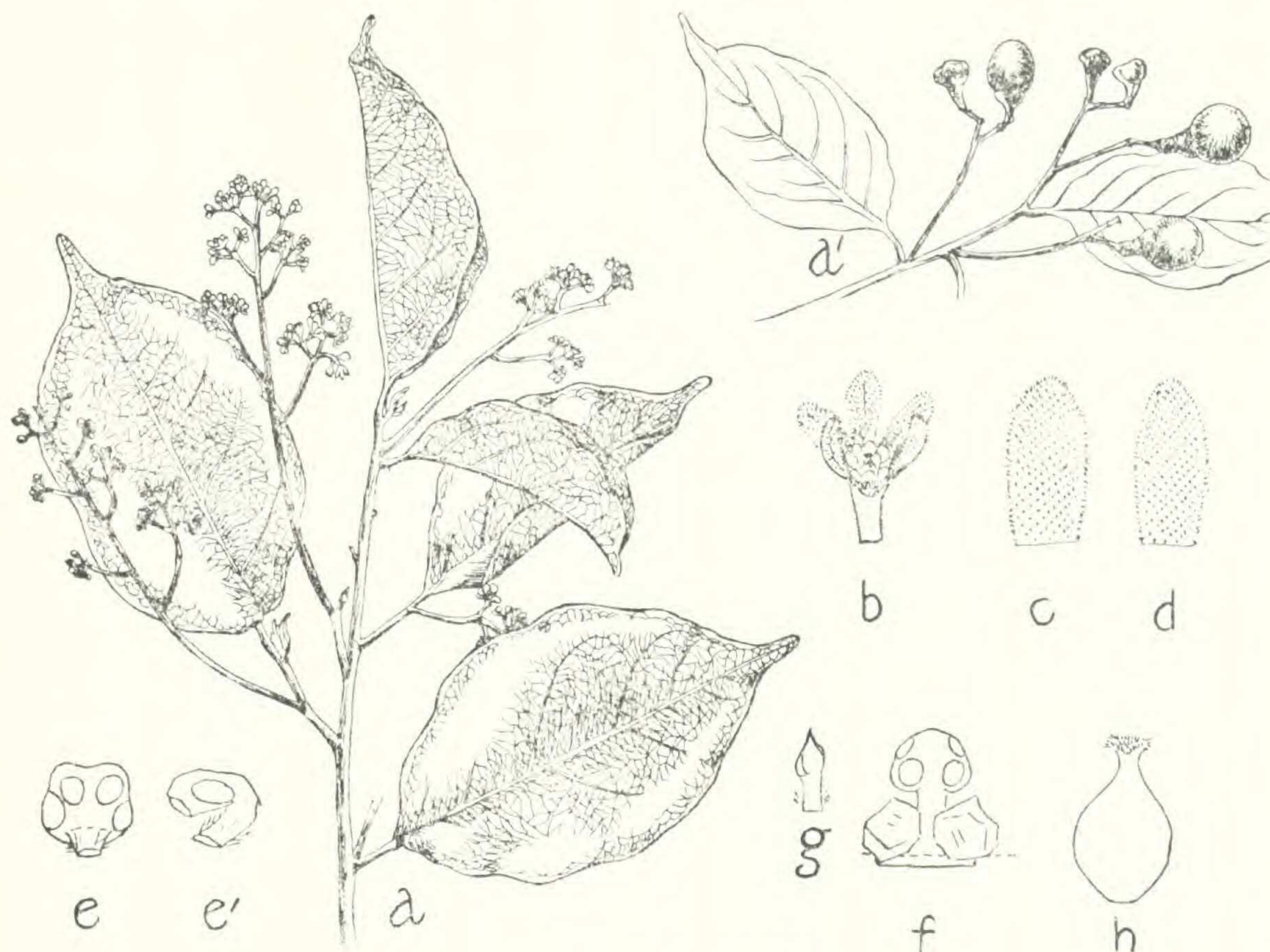


Fig. 33. *Nectandra latifolia*

Shrub or small tree to 8 m. high; branchlets early subferruginous- or yellowish-sericeous, becoming glabrous, reddish, striate. Leaves alternate or subopposite; petioles pubescent to glabrous, stout, usually canaliculate, 6–12 mm. long; blades becoming glabrous except for inconspicuous axillary glands, chartaceous to subcoriaceous, very shining above, dull beneath, elliptic, 12 (–15) cm. long and 3.5 (–6.5) cm. broad, the base cuneate to roundish, the apex caudate-acuminate, pinninerved, the costa and nerves somewhat obscure above and elevated beneath, the nerves 4–6 pairs, diverging from the costa at an angle of 35–50 (–55)°, the reticulation minute, exceedingly prominent above and beneath. Inflorescence axillary and subterminal, branching, subcorymbose-paniculate, to 9 (–13) cm. long, minutely pubescent, becoming glabrous, the peduncle to 5 cm. long. Flowers

to 6 mm. in diameter, the perianth-lobes thick, papillose, elliptic-ovate, 2.15–2.5 (–3.4) mm. long; stamens of ser. I & II 0.6–0.8 (–1) mm. long, the anthers more or less nutant, subreniform, slightly emarginate, twice the length of the rather stout filaments; those of ser. III 0.8 (–1) mm. long, the anthers squarish, about equaling the filaments, the glands conspicuous, sessile, nearly equaling the anthers; staminodia ovate, 0.6 mm. long, the stipes nearly one-half to two-thirds their entire length; gynoecium glabrous, 1.25 mm. long, the ovary subglobose or ellipsoid, nearly three times the length of the thick, short style, the stigma triangular-subcapitate. Fruit black, subglobose, about 1 cm. in diameter, the subtending cupule shallow, not more than 2 mm. long, 6 mm. in diameter, and 0.5 mm. deep, the margin slightly and finely undulate, the pedicel enlarged to 3–4 mm. long and 2.5 mm. in diameter at the apex.

Central America from Nicaragua through Panama, south through Colombia to Brazil, according to Mez. Occurring at low altitudes in Panama.

CANAL ZONE: without locality, *Christopherson* 132; hills near Gatún Station, Panama R. R., *Hayes* 95, 98, 229, 483; Gatún Lake, at turning point from canal, *Bangham* 425; Chagres, *Fendler* 54; Barro Colorado Island, *Aviles* 113, 950, *Bailey & Bailey* 92, 307, *Woodworth & Vestal* 692.

Outstanding because of the elliptic leaf-blades (reddish brown on drying) shining above and with minute reticulation exceedingly prominent above and beneath. See preceding species for discussion.

14. *NECTANDRA STANDLEYI* C. K. Allen in *Jour. Arnold Arb.* 26:396. 1945.

Tree 6–13 m. high; young branchlets minutely and densely fulvous- or subferruginous-pubescent, angled, becoming glabrescent, striate, gray or blackish brown. Leaves alternate; petioles fairly stout, fulvous-tomentose, canaliculate, to 1.5 cm. long; blades minutely pubescent above, inconspicuously so beneath, coriaceous, in the dried state brown, elliptic, to 16 (–22) cm. long and 4.5 (–7) cm. broad, obtuse or almost rounded at the base, recurved and seemingly cuneate at the extreme base, the apex attenuately acuminate or caudate-acuminate, pinnerved, the costa and nerves impressed above and conspicuously elevated beneath, the nerves 4 (–8) pairs, diverging from the costa at an angle of 25–35° (lowermost pairs sometimes to 55°), the reticulation obscure throughout. Inflorescence axillary or subterminal, paniculate, to 15 (–20) cm. long, fulvous- or gray-pubescent, many-flowered, the peduncle to 6 cm. long. Flowers to 3 mm. long, the pedicels pubescent, 2 mm. long, the perianth white, yellow, yellow-green or fulvous-flavescens according to the collector, campanulate, the lobes reflexed, fleshy, pubescent without, papillose within, elliptic, rounded, 1.7 (–2.15) mm. long; stamens of ser. I & II 0.6 mm. long, the anthers subreniform, subemarginate, subsessile; those of ser. III 1 mm. long, the anthers truncate, subemarginate, equaling the filaments, the glands laterally basal, conspicuous, subglobose, equaling the filaments; staminodia subovoid, 0.6 mm. long, the stipe nearly one-half the entire length; gynoecium glabrous, to 1.25 mm. long, the ovary ellipsoid, slightly longer

Fig. 34. *Nectandra Standleyi*

than the style, the stigma conspicuous, subtriangular, discoid. Fruit green according to the collector, subglobose, 1 (-1.3) cm. in diameter, the subtending cupule campanulate, glabrous, verrucose, the margin irregularly and shallowly lobed, 5-6 mm. long, 12 mm. in diameter, and 3 mm. high, the pedicel stout, verrucose, to 8 mm. long and expanded to 4-5 mm. in diameter at the apex.

Costa Rica from 250 to 1700 meters, and Panama presumably at low altitudes. Known as *Sigua*.

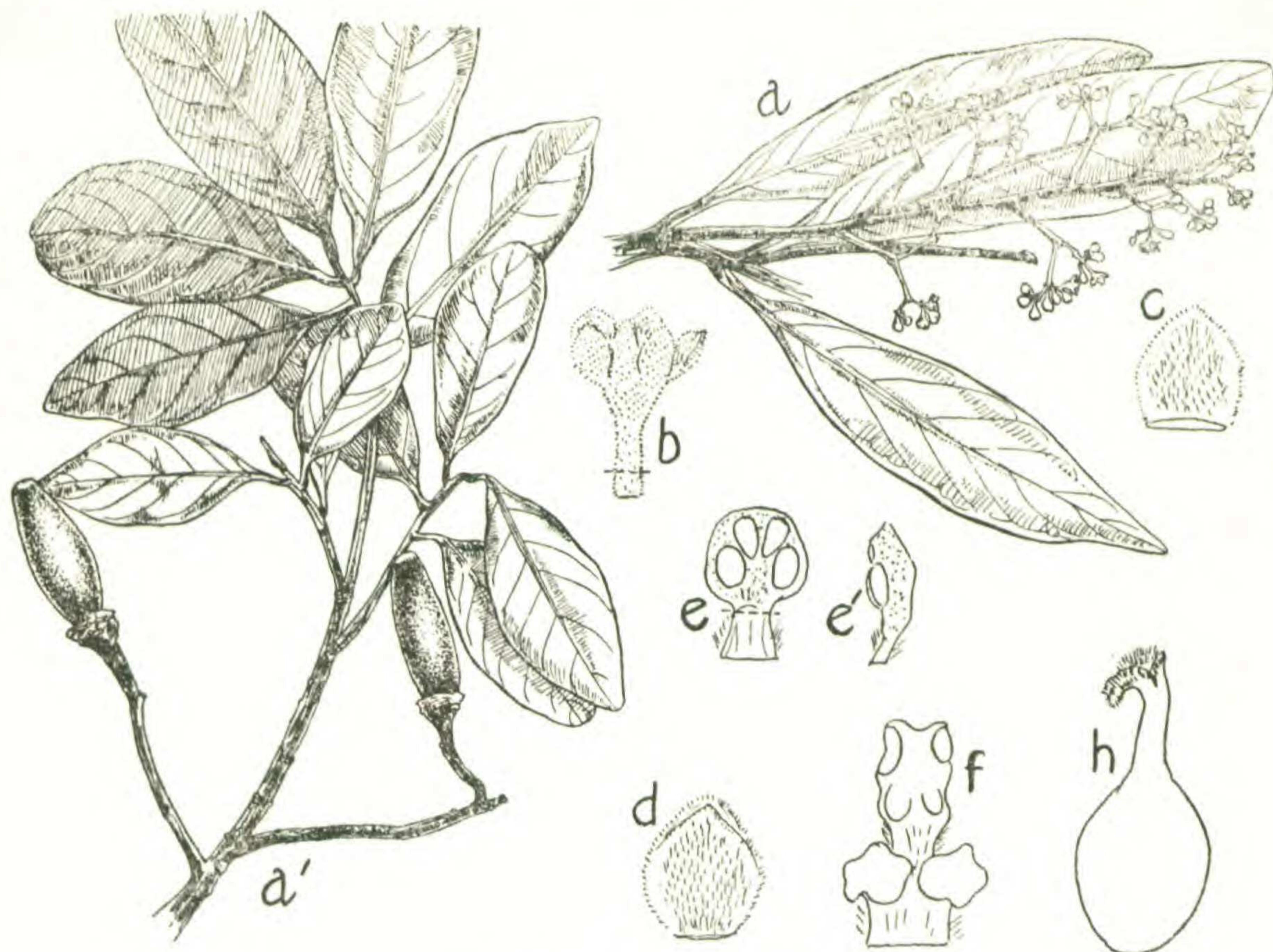
BOCAS DEL TORO: Cricamola, near Almirante, Cooper 488; vicinity of Chiriquí Lagoon, Big Bight, von Wedel 2884; Isla Colón, von Wedel 2967.

Similar to *Nectandra globosa* and *N. ramonensis* in foliage characters, but differing from the former in fewer pairs of lateral nerves and from the latter in larger leaf-blades, and from both species in its smaller flowers with anthers devoid of large papillose connective characteristic of the two above-mentioned species. The fruiting cupule of *N. Standleyi* is less shallow and the fruits tend to be subglobose.

15. *NECTANDRA WHITEI* (Woodson) C. K. Allen in Jour. Arnold Arb. 26:398. 1945.

Ocotea Whitei Woodson in Ann. Mo. Bot. Gard. 24:188. 1937.

Tree (6-) 20-30 m. high; branchlets slender, minutely and closely fulvous-sericeous, becoming glabrous, grayish and striate. Leaves alternate or subverticil-

Fig. 35. *Nectandra Whitemei*

late; petioles slender, glabrous or glabrescent, and about 1 cm. long; blades early fulvous-sericeous, becoming glabrous above and less conspicuously pubescent beneath, coriaceous, oblanceolate, 12 cm. long and 3.5 (–4) cm. broad, the broadest portion above the middle of the blade, the base narrowly attenuate and recurved giving the appearance of a long winged petiole 3 cm. in length, the apex obtuse or obtusely and abruptly acuminate, pinninerved, the costa slightly elevated above and more prominently so beneath, conspicuous throughout, the nerves 12 pairs, inconspicuous throughout, diverging from the costa at an angle of 35–45°. Inflorescence axillary or subterminal, paniculate, to 13 cm. long, the peduncle stout, reddish black, to 6 cm. long. Flowers about 3 mm. long, the pedicel slender, pubescent, not more than 3 mm. long, the perianth light greenish yellow, pubescent, the lobes rather thick, ovate-elliptic, subequal, 2.15 mm. long; stamens of ser. I & II 1 mm. long, the anthers subglobose, to twice the length of the stout filaments; those of ser. III 1.25–1.7 mm. long, the anthers squarish, almost equaled by the filaments, the glands subglobose, sessile, equaling the anthers; gynoecium glabrous, 2.15 mm. long, the ovary ovoid, slightly longer than the rather stout style, the stigma subtriangular, flat, decurrent. Fruit green becoming black, oblong or in the younger stages presumably ellipsoid, the surface frequently tuberculate, the apex in the dried state remaining conspicuously shining and unwrinkled, drying usually in a more or less regular star-shaped pattern, up to 4 × 1.5 cm., the subtending cupule cyathiform, red, verrucose, to 6 mm. long, 13 mm. in

diameter, and 2–3 mm. deep, the margin gently undulating, the pedicel verrucose, striate, up to 15 mm. long, and 6 mm. in diameter at the apex.

Western Panama and Costa Rica up to 2000 meters altitude. Known as *Bambito*.

CHIRIQUÍ: Valley of the upper Río Chiriquí Viejo, vicinity of Monte Lirio, *Seibert* 307; trail from Paso Ancho to Monte Lirio, *Allen* 1486.

Unique because of the long fruits. The species is near *Nectandra Paulii* from Costa Rica and Panama and *N. producta* from Costa Rica, but is distinguished from the former by shorter apparent petioles, and from the latter by its chartaceous leaf-blades, that are much smaller and with more prominent reticulation, and by its shorter inflorescences.

16. *NECTANDRA HYPOGLAUCA* Standley ex C. K. Allen in Jour. Arnold Arb. 26:399. 1945.

Tree 15–21 m. high; branchlets fulvous-sericeous becoming gray, striate, early angled, later terete. Leaves alternate; petioles stout, pubescent, apparently 2 (–2.5) cm. long, actually only 3.4 mm. long; blades glabrous above except at the base of the costa, shining, pubescent and glaucous beneath, coriaceous, in the dried state olive-brown, obovate-elliptic, to 18 cm. long and 8 cm. broad, the base attenuately cuneate, decurrent into the petiole, more or less strongly recurved through-



Fig. 36. *Nectandra hypoglaucia*

out, making an apparent petiole, the apex rounded, slightly obtuse, or abruptly acuminate, pinninerved, the costa slightly impressed above, rather elevated beneath, stout, the nerves 6–9 (or 10) pairs, scarcely elevated above, somewhat so beneath, more or less castaneous, diverging from the costa at an angle of 40° , the reticulation conspicuous throughout on the upper surface. Inflorescence axillary, paniculate, to 18 cm. long, bearing bracts in the early stages, densely fulvous-tomentose, the peduncles stout, striate, angled, to 8 cm. long. Flowers to 3.5 mm. long, the pedicels tomentose, to 4 mm. long, the perianth campanulate, densely fulvous-tomentose, canescent according to the collector, the lobes ovate, thick, obtuse, 2.5 mm. long; stamens of ser. I & II 1–1.25 mm. long, twice the length of the filaments, the anthers ovate, the connective one-third to one-half the length of the anthers; those of ser. III 1.25 (–1.7) mm. long, the anthers oblong, truncate, twice the length of the glands and filaments; staminodia broadly lanceolate, 0.8 mm. long; gynoecium glabrous, 1.7 (–3) mm. long, the ovary ovoid-globose or ellipsoid, twice the length of the style, the stigma triangular-peltate, conspicuous. Fruit in the dried state yellowish brown-maculate, obovoid-elliptic, conspicuously and obtusely apiculate, $2.2–2.5 \times 1.6–2$ cm., the subtending cupule campanulate, rugose, verrucose, glabrous, the margin slightly undulate, to 1 cm. long, 1.7 cm. in diameter and 5 mm. deep, the pedicel expanding to 15 mm. long and 5 mm. broad at the apex.

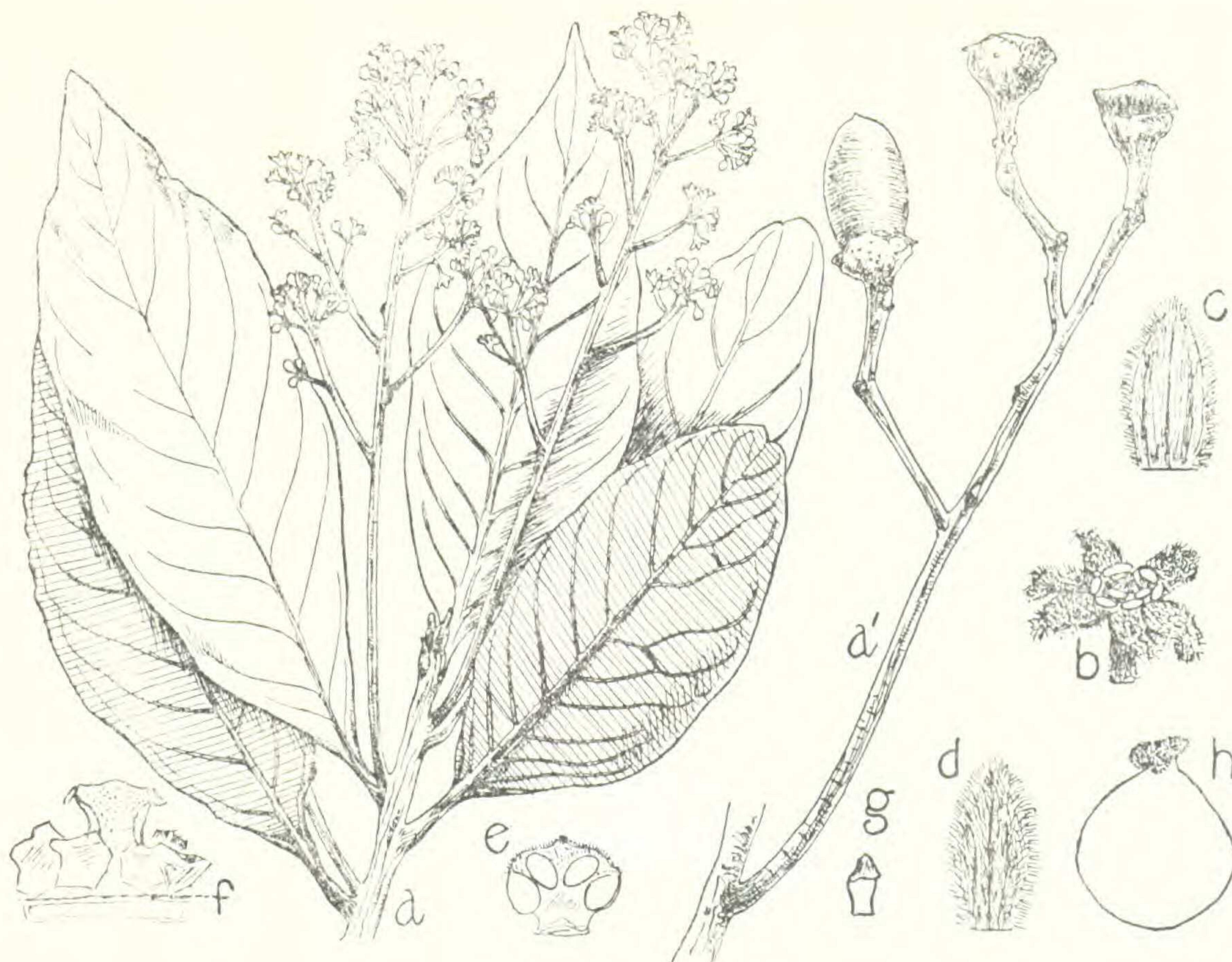
Known only from the rain-forests of Chiriquí, Panama, at 1340 meters altitude.

CHIRIQUÍ: Bajo Mona, Boquete, *Davidson* 531.

Outstanding for the robust branchlets and inflorescence covered with a fine but dense fulvous persistent tomentum, and the large coriaceous leaves that are shining above and glaucous-pubescent beneath.

17. *NECTANDRA PAULII* C. K. Allen in *Jour. Arnold Arb.* 26:400. 1945.

Tree to 30 m. high; branchlets stout, sulcate, minutely fulvous-tomentose, becoming gray-pubescent or glabrescent. Leaves alternate or subopposite, early sparsely and minutely appressed fulvous-pubescent becoming glabrescent, and eventually glabrous; petioles stout, pubescent, shallowly canaliculate, to 2 cm. long; blades glabrous above except for the base of the costa, below minutely pubescent, early membranaceous becoming coriaceous, in the dried state greenish brown, paler and subglaucous beneath, elliptic or obovate-elliptic, to 15 cm. long and 7 cm. broad, the base cuneate, somewhat recurved, decurrent into the petiole, the apex acute, acuminate or rounded, rarely emarginate, the margin slightly recurved, pinninerved, the costa stout, conspicuous above, beneath strongly elevated, the nerves (6 or) 7 or 8 (or 9) pairs, conspicuous above but slightly impressed, beneath elevated, diverging from the costa at an angle of $35–45^{\circ}$, the reticulation obscure throughout. Inflorescence axillary, broadly paniculate, to 30 cm. long, pubescent, many-flowered, the peduncle stout, pubescent, to 10 cm. long. Flowers to 3 mm. long, the pedicel slender, 1–3 mm. long, the perianth hypocrateriform, white according to the collector, the lobes reflexed, thick, papillose-tomentose,

Fig. 37. *Nectandra Paulii*

oblong, 2.5–3 mm. long; stamens of ser. I & II 0.6 mm. long, the anthers subreniform or depressed-globose, twice the length of the filaments; those of ser. III 0.8 mm. long, the anthers quadrate and equaling the filaments, the glands also equaling the filaments; staminodia oblanceolate, pubescent, to 0.8 mm. long; gynaecium glabrous, 1.25 mm. long, the ovary subglobose, the style almost lacking, the stigma subsessile, rounded-triangular, conspicuous. Fruit ellipsoid, apiculate, 28 × 17 mm., the subtending cupule red, campanulate, thick, verrucose, glabrous, to 8 mm. long, 15 mm. in diameter, and 5 mm. deep, the pedicel pubescent, striate, enlarged to 1 cm. long, and 8 mm. in diameter at the apex.

Costa Rica up to 915 meters altitude, and Chiriquí at 1800–2000 meters altitude.

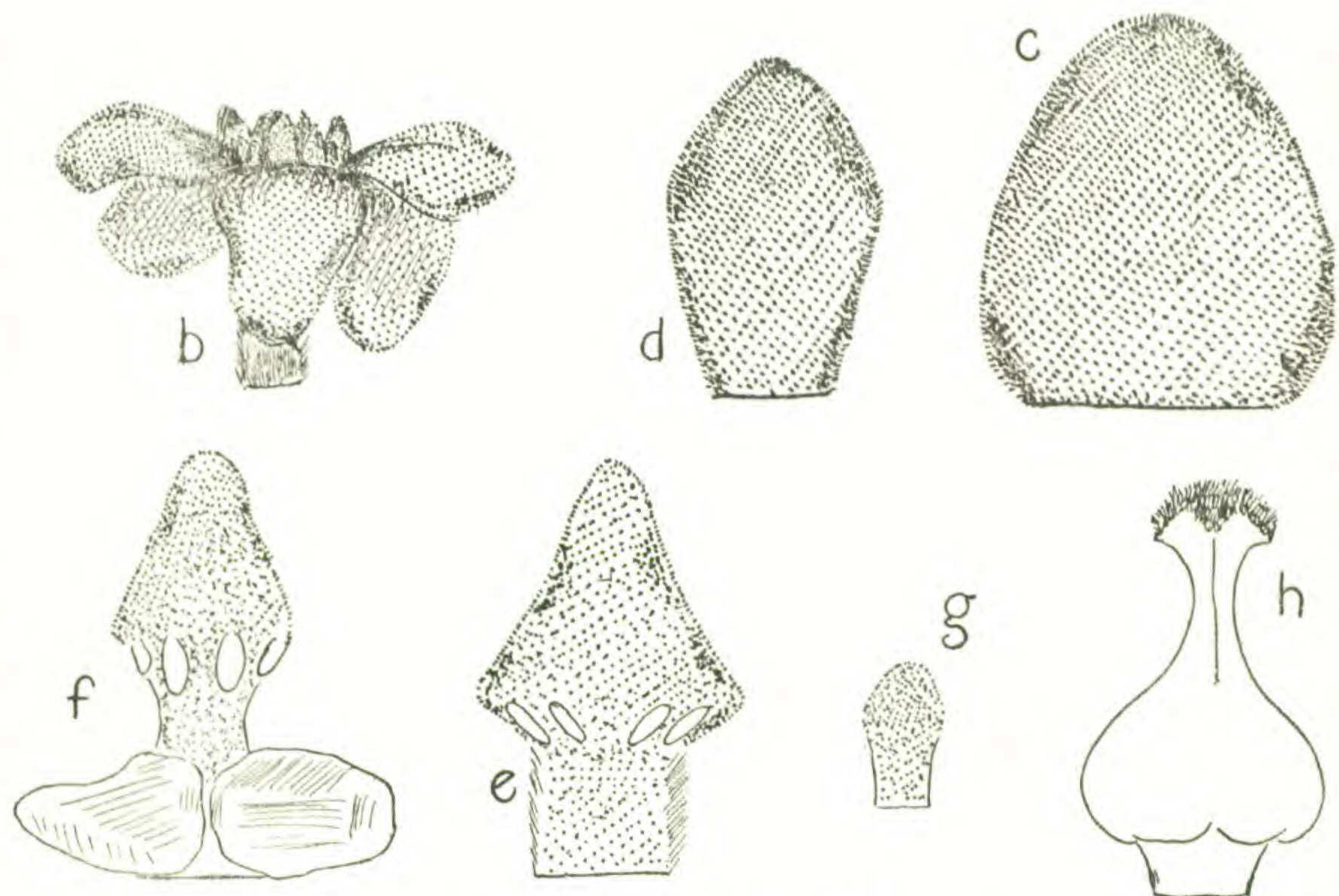
CHIRIQUÍ: Bajo Mona, mouth of Quebrada Chiquero, along Río Caldera, *Woodson*, *Allen & Seibert* 1022; vicinity of Cerro Punta, *Allen* 1572.

Near *Nectandra hypoglauca*, but differences in floral as well as fruiting characters separate the two species.

18. *NECTANDRA RETICULATA* (Ruiz & Pavon) Mez in Jahrb. Bot. Gart. Berlin 5:404. 1889.

Laurus reticulata R. & P. Fl. Peruv. 4:t. 348, & Laurogr. t. 23. 1802.

Tree 6–12 (–24) m. high; branchlets densely conspicuously ferruginous-tomentose. Leaves alternate or subopposite; petioles stout, densely tomentose, to

Fig. 38. *Nectandra reticulata*Fig. 39. *Nectandra reticulata*

1.5 cm. long; blades glabrous above except for the venation, coriaceous, lanceolate-elliptic or oblong-elliptic, to 30 cm. long and up to 10 cm. broad, the base auriculate and strongly recurved, the apex attenuate-acuminate, pinninerved, the costa impressed and pubescent above, prominently elevated and densely pubescent beneath, the nerves up to 12 pairs, impressed and pubescent above, prominently elevated and densely pubescent beneath, diverging from the costa at an angle of 35–45°, the reticulation pronouncedly impressed above and conspicuously elevated beneath. Inflorescence axillary, paniculate, usually 10–20 cm. long, stout, many-flowered, ferruginous-tomentose, the peduncles up to 11 cm. long. Flowers large, 7 (–10) mm. long and 10–15 mm. in diameter, the pedicel usually 4–5 mm. long, often less, the perianth densely tomentose, the tube frequently densely hairy within, the lobes fleshy, tomentose-papillose within, ovate, obtuse or rounded, nearly 6 mm. long, the inner slightly shorter than the outer; stamens of ser. I & II often variable in size, to 2.4 (–3) mm. long, the anthers almost sessile, or with stout filaments one-third the entire length of the stamens, depressed-globose, to ovate and almost petaloid, the connective tissue occupying usually about one-half, often three-fourths, the entire anther; stamens of ser. III also variable, to 3 mm. long, the anthers often squarish and emarginate or occasionally ovate, the filaments sometimes almost equaling the anthers, the glands conspicuous, spreading, sessile, nearly equaling the anthers; staminodia ovate or linear-lanceolate, usually hairy, 0.8 mm. or more long; gynoecium for the most part densely pubescent, occasionally glabrescent or even glabrous (in Panama usually glabrous), 3 mm. long, the ovary ovoid or ellipsoid, slightly longer than the stout style, frequently with short broad stipe, the stigma conspicuous, subcapitate. Fruit said to be ellipsoid, to 13 mm. × 8 mm., the subtending cupule subpateriform, slender, simple-margined, one-third the entire length.

Originally described from Peru, but found throughout tropical America, from Mexico through Central to South America. Growing at consistently low altitudes in Panama. Known as "Sweetwood."

BOCAS DEL TORO: Changuinola Valley, Island Potrero, *Dunlap* 22a; Changuinola Valley, *Cooper & Slater* 32 (Y 10132); region of Almirante, Cricamola, along river, *Cooper* 512. CANAL ZONE: forest along the Río Indio de Gatún, *Pittier* 2775; in swampy woods, Lion Hill Station, *Hayes* 467; Mindi, *Cowell* 182.

Easily the most striking and easily recognized species of Panama. Conspicuous for the densely ferruginous-tomentose branchlets, lower leaf-surfaces, and inflorescences. The blades are definitely strongly auriculate at the base and recurved to appear cuneate. The densely tomentose flowers are large, to 7 mm. long and 10–15 mm. in diameter.

5. BEILSCHMIEDIA Nees

BEILSCHMIEDIA Nees in Wallich, Pl. As. Rar. 2:61, 69. 1831.

Trees and shrubs. Leaves alternate or opposite, the blades pinninerved, usually prominently and loosely reticulate above. Inflorescences axillary or subterminal, paniculate, short and few-flowered usually. Involucre none. Flowers perfect. Perianth-tube short, shallow, broadly obconical. Perianth-lobes subequal, or the outer shorter, deciduous. Stamens with filaments bearing anthers with two large cells; those of the outer series large, ovate, flattish, the connectives conspicuously protruding beyond the large introrse cells; stamens of the inner series with narrower, thicker anthers, with the connectives protruding beyond the lateral or extrorse-lateral cells, the filaments biglandular. Staminodia large, ovate-acute or triquetrous, shortly stalked or sessile. Gynaecium usually glabrous; ovary sub-globose, short, merging into the thick short obtuse style. Stigma almost inconspicuous. Fruit usually ellipsoid, obtuse, outer layer thick or thin, usually fleshy, borne on a cylindrical, naked pedicel, scarcely elongated.

1. BEILSCHMIEDIA AUSTIN-SMITHII (Standley) C. K. Allen in Jour. Arnold Arb. 26:418. 1945.

Persea Austin-Smithii Standl. Field Mus. Publ. Bot. 18:1552. 1938.

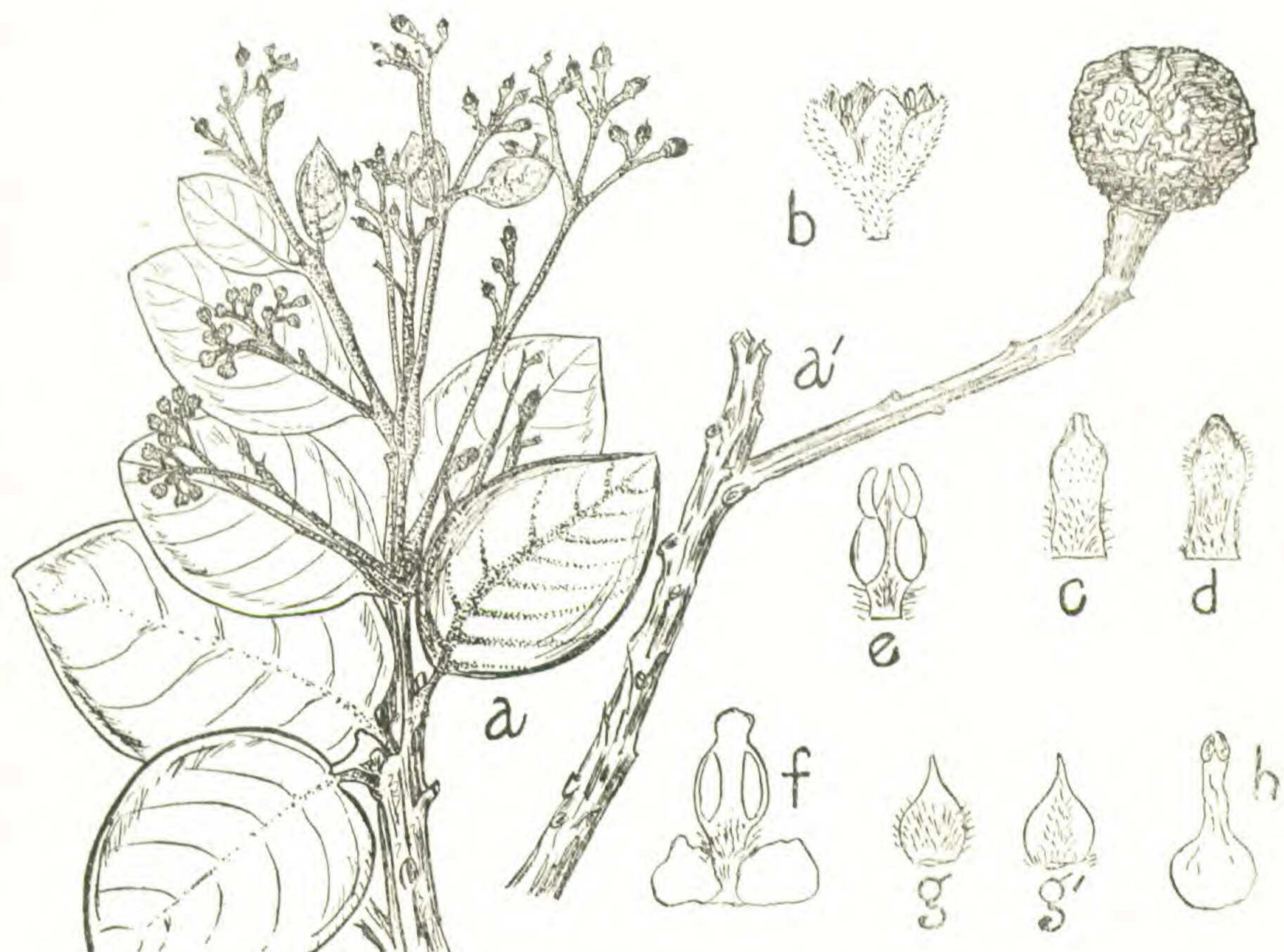


Fig. 40. *Beilschmiedia Austin-Smithii*

Tree to 30 m. high; branchlets densely foliose, the internodes very short, densely brownish-tomentose, angular or sulcate. Leaves alternate; petioles very thick, brownish-tomentose, to 1 cm. long; blades sparsely tomentellous, becoming almost glabrous above, beneath somewhat pubescent on the venation, rigidly coriaceous, brownish olive above, glaucous beneath, roundish ovate or suborbicular, 5.5–7 cm. long and 4.5–5 cm. broad, rounded at the base, often shortly and abruptly contracted into the petiole, the apex broadly rounded, pinninerved, the costa somewhat thickened and elevated, the nerves 3–4 (–7) pairs, arcuate, diverging at an angle of 55–65°, the reticulation prominulous. Inflorescence axillary, paniculate, loosely sordid-tomentose, many-flowered, longer than the leaves, long-pedunculate. Flowers to 4.7 mm. long, the pedicels about 2 mm. long, thick, tomentellous; perianth dull yellow-brown, the lobes ovate, very obtuse, brownish-tomentellous without, about 2 mm. long; stamens of ser. I & II 1.5 mm. long, the anthers elliptic, narrowly truncate, twice the length of the broad pubescent filaments, the connectives protruding; those of ser. III 1.7 mm. long, the anthers ovate, truncate, the filaments bearing large glands that are fused; staminodia large, subcordate; gynoecium glabrous, to 1.7 mm. long, the ovary ovoid, topped by a very short style, the stigma obtuse. Fruit depressed-globose, 3.4 × 2.7 cm., the subtending pedicel enlarged to 1 cm. long and 1 cm. in diameter at the tip, 0.5 cm. in diameter at the base, glabrous, somewhat rugose.

Known only from Costa Rica and Chiriquí, at an altitude of 2000 meters.

CHIRIQUÍ: vicinity of Cerro Punta, *Allen* 3490.

6. AIOUEA Aublet

AIOUEA Aublet, Pl. Guian. 1:310, t. 120. 1775.

Evergreen trees or shrubs. Leaves alternate, occasionally verticillate, the blades obovate, usually yellowish green above, somewhat paler beneath, pinninerved with more or less prominent nervation. Inflorescence of loose axillary pedunculate panicles. Bracts and bracteoles inconspicuous and early deciduous. Flowers small, perfect, usually subglobose or obconic, often with bloom. Perianth-tube shallow. Perianth-lobes approximately equal in size, and incurved. Stamens of all three series fertile (in Panama), with noticeable connective of varying length; anther-cells of two outer series introrse, and occupying almost the entire anther; two extrorse anther-cells of inner series, or four cells, the upper pair lateral and smaller than the lower extrorse pair; filaments of inner series conspicuously biglandular. Staminodia usually well developed, occasionally small and inconspicuous, but in Panama absent. Ovary glabrous. Style cylindrical and distinct from ovary or gradually increasing in diameter toward its junction with ovary. Stigma usually well developed and peltate, occasionally small and triangular. Fruit a berry, borne in a shallow, more or less fleshy cupule, the margin of which is plane, slightly undulate or (in Panama) bearing the remains of the six persistent and enlarged perianth-lobes.

The genus consists of thirty species, all but two of which occur in South America, the majority being native to Brazil. One species recorded from Costa Rica and the following species from Panama. Two of the South American species occur also in Trinidad. Timber used locally for construction and furniture.

1. *AIOUEA LUNDELLIANA* C. K. Allen in Jour. Arnold Arb. 26:419. 1945.

Tree 6–30 m. high; branchlets brownish gray, verruculose. Leaves alternate, verticillate, in early stages ferruginous-sericeous, presently glabrous; petioles thick-winged or decurrent, glabrous, canaliculate, to 2 cm. long; blades glabrous above, beneath slightly and obscurely pubescent, coriaceous, in dried state brown, obovate-elliptic, (12–) 16 (–18) cm. long and (5–) 7.5 cm. broad, the base attenuate-cuneate into the decurrent petiole and strongly recurved, the apex rounded or broadly acute or abruptly broadly and obtusely acuminate, rarely emarginate, the margin recurved, the costa scarcely elevated above, conspicuously and coarsely so beneath, the nerves 7 or 8 pairs, obscurely impressed above, elevated beneath, diverging from the costa at an angle of about 45° , the reticulation obscure above and prominulous beneath. Inflorescence broadly paniculate, up to 20 cm. long, glabrescent, many-flowered, long-pedunculate. Flowers up to 3 mm. long with equal pedicels; perianth subcampanulate, yellowish green, fragrant, the lobes more or less oblong or ovate, somewhat membranaceous, pubescent, \pm 1.9 mm. long;

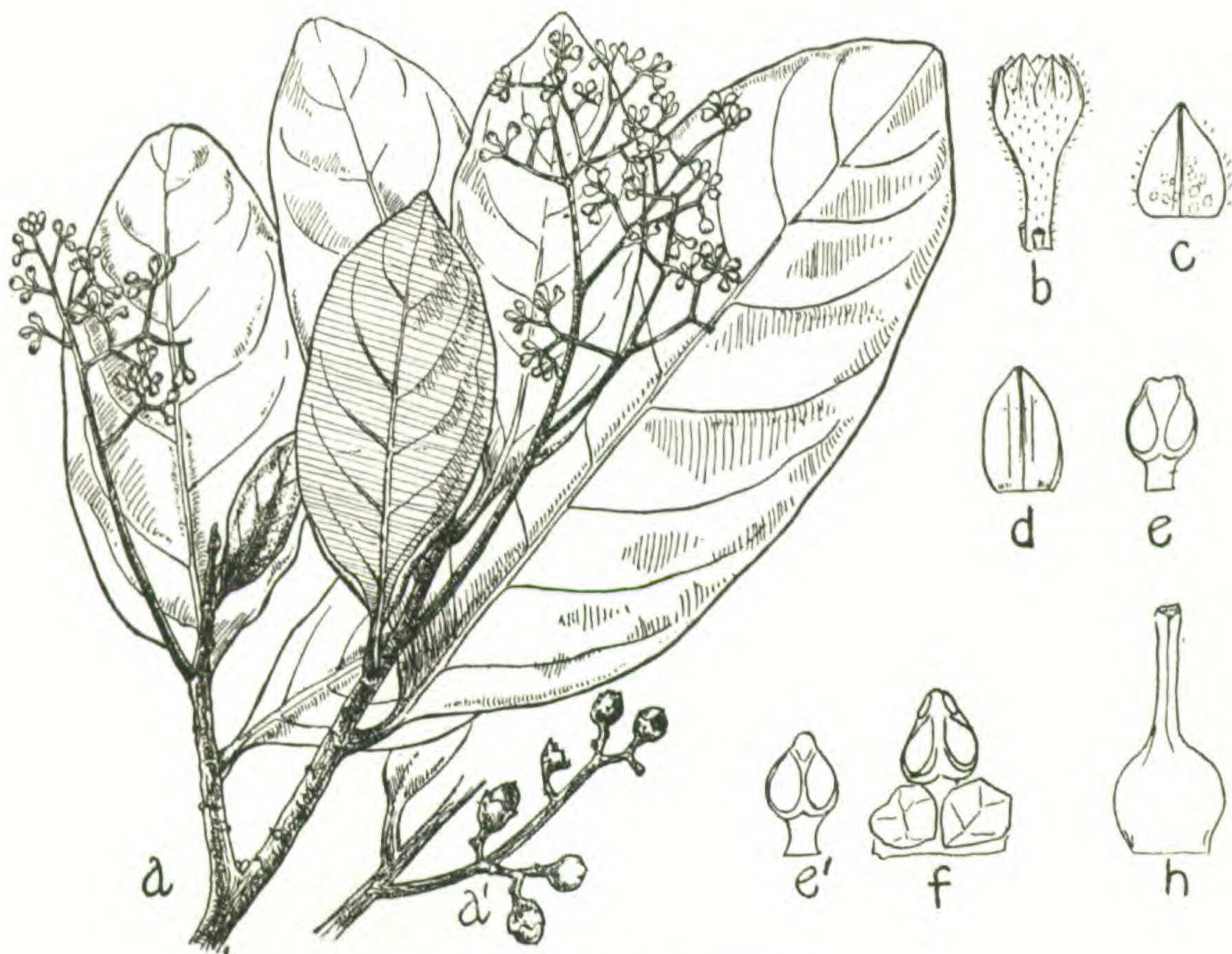


Fig. 41. *Aioea Lundelliana*

stamens of ser. I & II \pm 1.25 mm. long, the filaments shorter than or almost equaling the anthers; those of ser. III \pm 1.7 mm. long, the anthers often slightly narrower and conspicuously biglandular, often 4-celled; staminodia none; gynoecium glabrous, \pm 2.15 mm. long, the ovoid ovary equaling the style, the stigma small, inconspicuous. Fruit immature (?), green, oblong, 6 \times 4 mm., the campanulate cupule more or less verruculose at the base, coarsely 6-toothed, glabrous, 6-7 mm. long, 6 mm. in diameter, and 3 mm. deep, the pedicel thickened, glabrous, 3 (-5) cm. long.

Known only from the rain-forests of eastern Panama, up to 2000 meters altitude.

CHIRIQUÍ: Río Chiriquí Viejo valley, near El Volcán, P. White 225; vicinity of Cerro Punta, Allen 1570; Bajo Chorro, Boquete, Davidson 435.

Differs from *Aiouea costaricensis* in having larger leaf-blades, abruptly, obtusely and shortly acuminate, with only slightly prominent reticulation beneath.

7. ENDLICHERIA Nees

ENDLICHERIA Nees in Linnaea 8:37. 1833 (non Presl).

Evergreen trees or shrubs. Leaves alternate and/or subverticillate, thinly chartaceous to rigidly coriaceous, pinninerved, rarely subtriplinerved or subquintuplinerved, the lower surface often densely, microscopically puncticulate. Inflorescence axillary or subterminal, few- to many-flowered panicles. Bracts and bracteoles persistent or deciduous. Flowers dioecious, without involucre. Perianth-tube distinct, shallow to subglobose. Perianth-lobes 6, usually equal, mostly spreading and reflexed at anthesis. Staminate flowers with 9 fertile stamens in three series, the inner distant from the two outer. Anthers of outer stamens 2-celled, introrse or introrse-lateral, sessile or borne on filaments. Anthers of inner stamens usually 2-celled, extrorse or extrorse-lateral, the filaments biglandular. Staminodia generally absent, or if present very minute. Pistillate flowers usually smaller, and often borne on much shorter pedicels in usually shorter, more narrow panicles. Stamens similar, smaller and sterile. Ovary immersed in the tube, large, usually glabrous, but pubescent in Panamanian species. Style usually short and thick. Stigma discoid or peltate, distinct, varying in size, often 3-parted. Fruit usually ellipsoid, glabrous, borne in shallow subhemispherical fleshy simple-margined cupule, the pedicel enlarged, fleshy and thick.

The genus consists of forty species, one occurring in the West Indies and one in Panama, the rest in South America.

1. ENDLICHERIA BROWNIANA Mez in Jahrb. Bot. Gart. Berlin 5:115. 1889.

Oreodaphne glomerata Seemann, Bot. Voy. H. M. S. Herald, 193. 1854.

Aydendron macrophyllum Meissner in DC. Prodr. 15¹:92. 1864.

Tree to 20 m. high; branchlets thick, subterete, minutely yellowish-appressed-tomentellous. Leaves alternate, early silvery-sericeous; petioles stout, obscurely

canaliculate, sulcate, densely sericeous-tomentellous, 1–2 cm. long; blades glabrous and shining above, beneath slightly sericeous, coriaceous, in the dried state green, broadly elliptic, 22–40 cm. long and 10–15 cm. broad, the apex somewhat obtuse or shortly acuminate, base acutish or somewhat obtuse, the costa very prominent, the lateral nerves 8 or 9 pairs, prominent, slightly arcuate, the reticulation coarsely prominent. Inflorescence axillary, few-flowered, sericeous-tomentellous, paniculate, up to 15 cm. long, the peduncles short, thick. Pistillate flowers 2.5–3 mm. long, the pedicels to 2 mm. long; perianth pink, pilose, the tube urceolate, 1.5 mm. long, slightly constricted at the apex, the inner surface sericeous-tomentellous; the lobes equal, erect-spreading, fleshy, somewhat flat, narrowly ovate, acutish, 1.5 mm. long, the inner surface tomentellous; stamens minute, 0.8 mm. long, well developed, substerile, the anthers ovate, acutish or truncate, the connective distinctly protruding beyond the small cells, the filaments very short, broad, densely pilose, those of ser. III biglandular; gynoecium pubescent, the ovary large, immersed in the perianth-tube, densely verruculose (sericeous-tomentellous), thickly ovoid, attenuate into a short style, the stigma distinct, discoid, subtriangular. Fruit unknown, the subtending cupule subhemispherical, rather smooth, to 11 mm. in diameter and 8 mm. high, merging into the obconical pedicel enlarged to 1 cm. in length.

Originally described from Seemann's collection from Cape Corrientes, then considered a part of the old province of Darién, Panama; now a part of modern Colombia. Presumably found at low altitudes along the sea-coast.

BOCAS DEL TORO: Fish Creek Mts., vicinity of Chiriquí Lagoon, *von Wedel* 2257.

8. LICARIA Aublet

LICARIA Aublet, Pl. Guian. 1:313, t. 121. 1775.

Misanteca Schlect. & Cham. in Linnaea 6:367. 1831.

Acrodielidium Nees, Laur. Expos. 13. 1833.

Chaneckia Lundell in Phytologia 1:177. 1937.

Evergreen trees or shrubs. Leaves usually alternate or occasionally opposite, the blades chartaceous or coriaceous, penninerved, usually somewhat thickened along the margin. Inflorescence usually of axillary and subterminal few- to many-flowered panicles. Involucre lacking. Flowers perfect. Perianth-tube usually distinct, occasionally short or even lacking. Perianth-lobes usually approximately equal. Stamens of ser. I & II small, only occasionally petaloid, and occasionally aborted, those of ser. III fertile, filamentous or sessile, usually biglandular, the anthers 2-celled, extrorse or apically extrorse. Staminodia usually absent. Ovary glabrous or sericeous, immersed in tube. Style slender. Stigma minute. Fruit first included in the enlarged tube, finally exserted, the base enclosed in a simple and thinly margined or thick and double-, rarely triple-margined cupule.

The genus consists of 48 recognized species, 32 of which are native to South America, 6 each from Mexico and Central America, including a single species from Panama, and 4 from West Indies. Timber good for general construction, but too scarce to be used to any great extent commercially.

1. *LICARIA EXCELSA* Kostermans in Meded. Bot. Mus. Utrecht 42:595. 1937 (Rec. Trav. Bot. Néerl. 34:595. 1937).

Acrodiclidium excelsum Lundell in Amer. Midl. Nat. 19:428. 1938.

Large tree to 60 m. high, the trunk erect; branches gray, glabrous; branchlets thick, glabrous, with lenticels rather numerous, often somewhat shining, sulcate. Leaves alternate; petioles stout, glabrous, up to 23 mm. long; blades glabrous, rigidly coriaceous, almost shining, elliptic or subovate-elliptic, 20 (-24) cm. long and 5 (-8) cm. broad, the base shortly acute, the apex acuminate, the costa broad above, flattened beneath, prominulous and broadly flattened towards the base, the lateral nerves at least 10 pairs, filiform, prominulous above and beneath, erect-spreading, arcuate, the reticulation prominulous, very densely and minutely areolate. Inflorescence axillary and subterminal, paniculate, before anthesis densely ferruginous-sericeous-tomentellous, becoming glabrous. Infructescence stout, to 15 cm. long. Fruit ellipsoid-ovoid, glabrous, 2.5×2 cm., the subtending cupule almost hemispheric-cylindrical, conspicuously verruculose, 20 mm. long, 25 mm. in diameter, and 16 mm. deep, the margin obscurely double, the outer entire and



Fig. 42. *Licaria excelsa*

thickened, the inner extending less than 2 mm. above the outer, thinner, exhibiting a tendency to split at intervals towards the base, the pedicel enlarged to 15 mm. long and 10 mm. in diameter at the apex.

Panama and adjacent Costa Rica, in rain-forest. Known as *Siguatón*.

CHIRIQUÍ: southern slope of the mountain in moist forest, Cerro de la Horqueta, near castle of Las Siguas, *Pittier* 3200; rain-forest of Bajo Chorro, Boquete, *Davidson* 361; vicinity of Cerro Punta, *Allen* 3482.

Conspicuous because of the very large rigidly coriaceous leaf-blades, probably the largest to be found in the family in this area.

HERNANDIACEAE

Trees, usually with rather soft, white wood; leaves alternate, usually long-petiolate, simple or palmately lobed, occasionally with cystoliths or oil cells, and somewhat aromatic; flowers usually small, bisexual or unisexual, with a 2-seriate, undifferentiated or poorly differentiated, valvate perianth, borne in axillary or pseudoterminal, many-flowered panicles or thyrses; the staminate with 3-6 two-valved stamens frequently accompanied by glandular staminodia; the pistillate with a 1-celled, inferior ovary containing a single, pendulous ovule and rather fleshy stigma, frequently with glandular staminodia; fruit a drupe or 2-winged samara, the seed without endosperm.

Unlike the Lauraceae, to which they are related so closely, Hernandiaceae are very infrequent in tropical forests, usually found only as isolated specimens at rather low elevations. Besides *Hernandia*, the genera *Gyrocarpus* and *Spatanthelium* are to be expected in Panama, since both are known to occur in Costa Rica and Colombia.

1. HERNANDIA L.

HERNANDIA L. Sp. Pl. 981. 1753; Pax in Engl. & Prantl, Nat. Pflanzenfam. 3²:129. 1889.

Hertelia Neck. Elem. 2:345. 1790.

Hernandezia Hoffmmsgg. Verz. Pflz. Nachtr. 1:219. 1824.

Biasolettia Presl, Rel. Haenk. 2:141. 1835.

Hernandiopsis Meissn. in DC. Prodr. 15:264. 1864.

Trees; leaves broad and long-petiolate, entire; flowers unisexual, borne in clusters of 2 staminate and 1 pistillate in sessile, involucrate cymules at the ends of the inflorescence branches; staminate flowers with 3 outer and 3 inner perianth lobes united at the base into a pedicel-like tube, containing 3 stamens and 3-6 glandular staminodia; pistillate flowers with 4 outer and 3 inner perianth lobes united at the base into a tube, the ovary enclosed within a more or less foliaceous cupule, the stigma fleshy, funiform, accompanied by 4 sessile, glandular staminodia inserted at the orifice of the perianth tube; fruit a nut, usually more or less 8-ribbed, enclosed within the greatly enlarged cupule.

Fig. 43. *Hernandia stenura*

- a. Leaves ovate-oblong, broadly rounded at the base, not cordate, glabrous; pistillate cupule more than half as long as the perianth tube, rather thin in texture, the orifice obscurely and unequally 3-lobed, not involute..... 1. *N. DIDYMANTHA*
- aa. Leaves broadly ovate, the base broadly cordate, more or less cinereous-puberulent beneath; pistillate cupule about one-third as long as the perianth tube, fleshy, truncate, the orifice margin strongly involute..... 2. *N. STENURA*

1. *HERNANDIA DIDYMANTHA* Donn. Sm. in Bot. Gaz. 31:120. 1901.

Trees 10–25 m. tall, buttresses absent or poorly developed; branchlets irregularly angulate, inconspicuously canescent to glabrous; leaves long-petiolate, the blade ovate-oblong, apex acutely acuminate, base broadly rounded, 15–30 cm. long, 6–15 cm. broad, membranaceous, glabrous when mature, the petioles 5–8 cm. long, glabrous; inflorescences about half as long as the subtending leaves, bearing several reduced, shortly petiolate leaves above, the ultimate branches terminating in involucrate cymules bearing 2 staminate and 1 pistillate, sessile or subsessile flowers; staminate flowers about 1 cm. long, densely canescent, the elliptic-oblong perianth lobes about equalling the tube, stamens 3, each subtended by paired, sessile staminodia, 4 mm. long, the anthers about as long as the filaments; pistillate flowers about 1 cm. long, densely canescent, the elliptic-oblong perianth-lobes about equaling the tube, the cupule more than half as long as the perianth-tube, somewhat longer than broad, rather thin in texture, the orifice obscurely and unequally 3-lobed, not involute. Mature fruit unknown.

Rain forest, northwestern Panama and adjacent Costa Rica.

BOCAS DEL TORO: Buena Vista Camp on Chiriquí Trail, alt. 1800 ft., Jan.-March, 1928, *Cooper* 618. CHIRIQUÍ: Progreso, 1927, *Cooper & Slater* 220, 272.

Cooper and Slater report that the trees of *H. didymantha* are not used for timber because the wood is light and soft, with a "woolly grain." Native names are *cebo macho* and *cebo burro*.

2. *HERNANDIA STENURA* Standl. in Field Mus. Publ. Bot. 18:1553. 1938.

Trees 7–15 m. tall; branchlets conspicuously angulate, minutely canescent to glabrate; leaves long-petiolate, the blade very broadly ovate, subcaudate-acuminate, broadly cordate, 12–30 cm. long, 6–20 cm. broad, membranaceous, minutely canescent to glabrate beneath, the petioles 7–12 cm. long; inflorescences about half as long as the subtending leaves, bearing several reduced, shortly petiolate leaves above, the ultimate branches terminating in canescent, involucrate cymules bearing 2 staminate and 1 pistillate, sessile or subsessile flowers; staminate flowers about 1 cm. long, densely canescent, the elliptic-oblong outer perianth lobes about equalling the tube, the stamens 3, each subtended by paired sessile staminodia, 4 mm. long, the anthers somewhat longer than the filaments; pistillate flowers about 1.2 cm. long, the perianth lobes about equalling the tube, the cupule about one-third as long as the perianth tube, about 2 mm. long and 4 mm. broad, fleshy, the orifice margin strongly involute. Mature fruit unknown.

Rain forest, northwestern Panama and adjacent Costa Rica.

BOCAS DEL TORO: Water Valley, November, 1940, Wedel 1684, 2148.

This species has been confused with the Antillean *H. sonora* L., which has smaller, obviously peltate leaves, and different floral structure. The wood of *H. stenura* is said to be very soft.

PAPAVERACEAE

Dicotyledonous annual, biennial, or perennial herbs (rarely woody), usually having a milky, yellow, or orange, acrid juice; leaves alternate, exstipulate, usually lobate or dissected; inflorescence ranging from solitary flowers to large, many-flowered compound panicles or cymes; flowers mostly polypetalous (apetalous in *Bocconia*), perfect, regular, hypogynous, frequently very large and showy; sepals 2 or 3, subvalvate or imbricate; petals 4-12, rarely absent, spreading, imbricate, frequently early caducous; stamens several to many, free; filaments filiform; anthers erect, bilocular, longitudinally dehiscent; ovary free, 2- to several-carpellate, usually 1-loculate (sometimes 2-loculate or imperfectly few- to several-loculate), 1- to many-ovulate; style short or obsolete; stigmas as many as the carpels, distinct or more or less adnate to the top of the ovary; fruit capsular, dehiscing by pores or valves, frequently containing an acrid or narcotic juice.

A relatively small family, chiefly of the northern temperate zones of both hemispheres, poorly and somewhat atypically represented in Panama and the tropics generally. The family contains many species of ornamental value, and also the opium poppy (*Papaver somniferum*) of considerable commercial and human significance.

Only two genera are indigenous to Panama, only one of which (*Bocconia*) is at all common. In addition, possibly a few species of ornamental poppy (*Papaver*) and the California poppy (*Eschscholtzia californica*) may occur under cultivation in the country. Both of these genera resemble *Argemone* but lack its prickly leaves. *Eschscholtzia* can be distinguished from *Papaver* by the linear capsule.

- a. Unarmed trees or shrubs; flowers apetalous, the stigmas prominent; capsule 1-seeded..... 1. BOCCONIA
- aa. More or less spiny herbs, rarely shrubs; flowers with conspicuous petals, the stigmas sessile; capsule many-seeded..... 2. ARGEMONE

1. BOCCONIA L.

BOCCONIA L. Sp. Pl. 505. 1753.

Small trees or shrubs (or subherbaceous perennials when young) of higher elevations, the branchlets thick, coarse, often gnarled, pithy and weak; leaves simple, large, usually lobate and dentate but in some species subentire, several-ranked, usually conspicuously lighter below than above, pinnately nerved, reticulate, varying considerably according to position on the plant; inflorescence a large, graceful panicle, terminal, subterminal, or lateral from the branchlets; bracts and

bractlets small and narrow, frequently caducous; pedicels slender; flowers numerous, apetalous, whitish; sepals 2, usually oblong or elliptic, concave, sessile; stamens few to many, invested by the sepals, the anthers slender, the filaments short; ovary fusiform, stipitate, bearing a single basifixated ovule; style slender; stigma bilamellate, extended beyond the sepals and stamens, very conspicuous; fruit somewhat fleshy, dehiscing by 2 lateral valves opening first from the base, the replum persistent after dehiscence and fall of the seed; the single seed conspicuously arillate basally.

New World tropics and subtropics.

The genus is unusual in the family in not being herbaceous and in having apetalous flowers and a 1-seeded fruit. It must be considered as somewhat atypical of the Papaveraceae.

As here interpreted a single species occurs in Panama.

1. *BOCCONIA FRUTESCENS* L. Sp. Pl. 505. 1753.

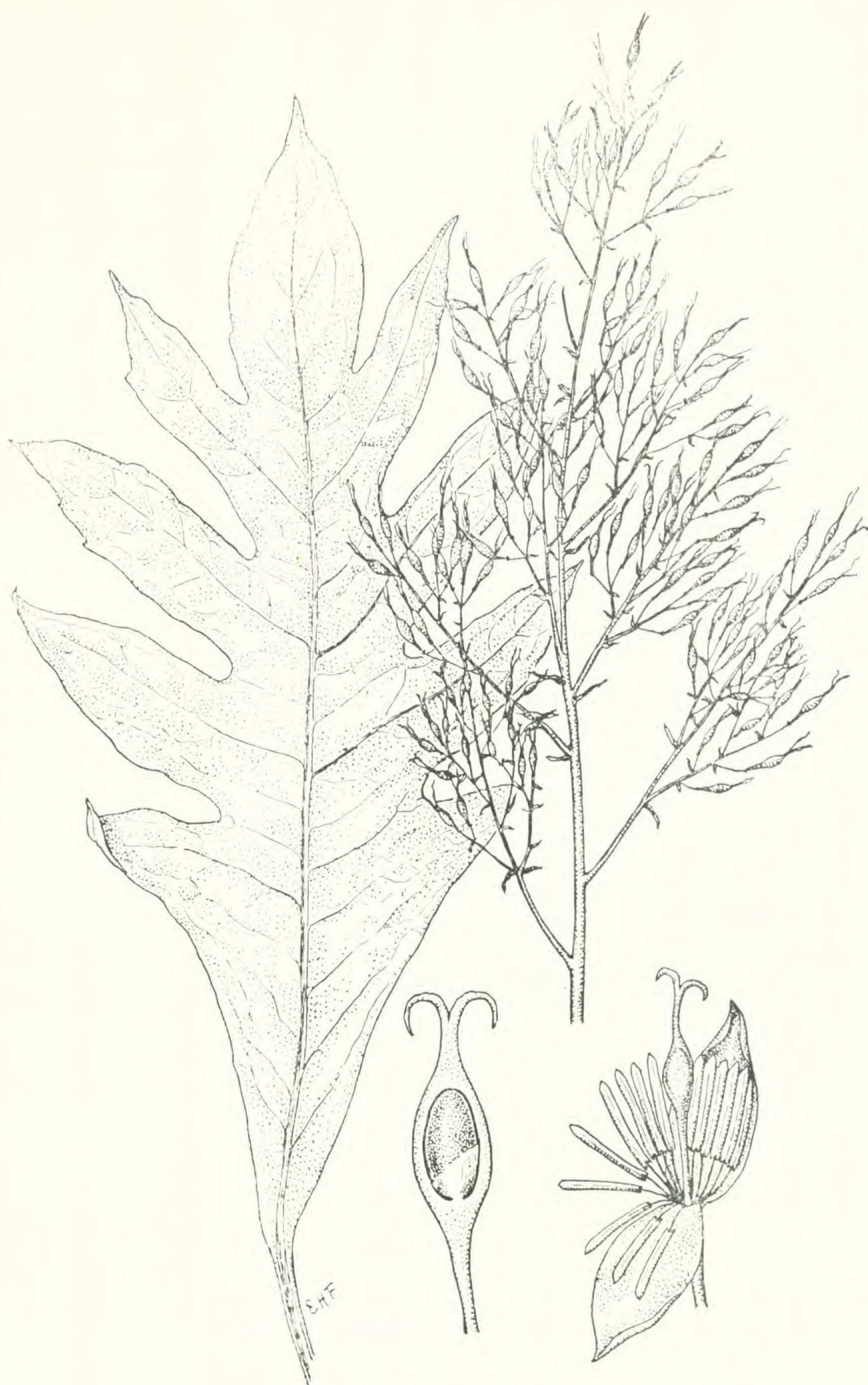
Numerous synonyms occur for this species, most of which are listed by Hutchinson in his treatment of the genus (Kew Bull. 278. 1920.).

Small tree or shrub, or subherbaceous when young, the branchlets glabrous, frequently glaucous towards the tip; leaves very variable in size and shape, tending to be less lobate toward the tips of the twigs; petioles from almost obsolete in young leaves to several cm. long in older ones, glabrous or minutely papillose-pubescent especially above, canaliculate above, fleshy; blade more or less obovate in outline, up to 45 cm. long or longer and as much as 30 cm. wide, rounded or cuneate basally, acute apically, from subentire or moderately lobed in young leaves to pinnatisect in old leaves, the lobes usually obscurely dentate and acute, normally minutely papillose-pubescent and markedly reticulate below, subglabrous and darker above, the lateral veins prominent; inflorescence commonly 30 cm. long or longer, essentially glabrous; bracts linear-lanceolate, the lower ones as much as 2 or 3 cm. long, the bractlets about 5 mm. long; flowers many, relatively unattractive; sepals 2, oblong-elliptic, about 1 cm. long, obtuse and abruptly short-acuminate, subglabrous; stamens 12 or more, the filaments very slender, about 3 mm. long, the anthers linear, 6-7 mm. long; ovary 3-4 mm. long, glabrous, the stipe 4-10 mm. long; style as much as 6 mm. long; stigma bilamellate, tomentulose above, the lamellae about 5 mm. long; fruit ellipsoidal, the locule in maturity about 1 cm. long, dehiscent as described for the genus.

Mexico, Central America and West Indies to middle South America.

CHIRIQUÍ: Bajo Chorro, Davidson 84; Boquete, Pittier 2879; Cerro Punta, Allen 309; Río Chiriquí Viejo, Allen 1593; Volcán de Chiriquí, Davidson 920; Woodson, Allen & Seibert 867. COCLÉ: El Valle de Antón, Hunter & Allen 314. DARIÉN: Cana, Williams 805.

A number of the cited specimens might well key to such species as *B. arborea*, *B. Pearcei* or *B. integrifolia* in Hutchinson's treatment of the genus. However, in comparing Panamanian material with that of Mexico, other parts of Central America, the West Indies and South America it becomes clear that Hutchinson's

Fig. 44. *Bocconia frutescens*

specific distinctions break down in Panama, where intermediacy and probable hybridization are found. In particular the Darién specimen (*Williams 805*) much resembles the Colombian *B. integrifolia* (ex char.), but its only large leaf has a few lobations and the petiole has less pubescence than described for that species. One would judge here an intermediate condition between *B. frutescens* and *B. integrifolia*. The *Davidson 84* collection also appears quite distinctive, possessing smaller glabrous leaves and very condensed internodes not typical of the species. Yet this may be but a reflection of a disadvantageous or seasonal environment at the unusually high altitude where collected. Still other specimens might be considered equally well either *B. arborea* (Mexican type) or *B. frutescens*. It is felt that all these specimens had better be regarded as one species (incidentally all had been originally determined in herbaria as a single species, *B. frutescens*), at least until further collections may permit more comprehensive analysis.

2. ARGEMONE L.

ARGEMONE L. Sp. Pl. 508. 1753.

Echtrus Lour. Fl. Cochinch. 1:344. 1790.

Herbs or rarely shrubs, usually glaucous and armed with prickles, the juice or sap yellowish; leaves alternate, sessile, pinnatifid to repand-lobate, the lobes spinulose-dentate and rigidly spined terminally; flowers large, solitary, terminal, or terminal on short axillary branches and thus appearing somewhat racemose or cymose, usually yellow or cream, rarely in some species red or purple; buds erect; sepals 2 or 3, usually bearing prickles, early caducous; petals 4-6, large and showy; stamens many; ovary ovoid to obovoid, many-ovulate, with 3-6 parietal placentae, usually armed; style short; stigma depressed, the lobes radiating from the center; capsule usually oblong, spiny, opening by 3-6 valves at the top; seeds crested, scrobiculate.

Temperate, subtropical, and to a lesser extent tropical regions of the New World; naturalized in Old World.

A "typical" genus of the family. A single species occurs in Panama.

1. *ARGEMONE MEXICANA* L. Sp. Pl. 508. 1753.

Echtrus trivialis Lour. Fl. Cochinch. 1:344. 1790.

Argemone ochroleuca Sweet, Brit. Fl. Gard. 3: pl. 242. 1828; fide Standl. & Steyermark.

Argemone mexicana var. *ochroleuca* (Sweet) Lindl. in Bot. Reg. pl. 1343. 1830.

Coarse, prickly annual of sunny habitats, seldom as much as 1 m. tall; stems fleshy, lightly setose-spinose, containing a yellow sap; leaves moderate, sessile, the blade mostly obovate in outline, 5-25 cm. long and up to 8 or 9 cm. wide, the upper leaves smaller, irregularly lobed or incised, the lobes spinose-dentate and rigidly mucronate at the apex, glabrous, glaucous, pinnate-veined, the lateral veins few, obscurely and laxly reticulate; inflorescence as described for the genus; sub-

tending bracts consisting of 2-3 very reduced leaves from condensed nodes; flowers showy, light or dark yellow; sepals 3, roughly ovate, about 2 cm. long, rigidly mucronate-spinose apically, usually bearing a few smaller spines below, glabrous and glaucous; petals normally 6, broadly obovate, mostly 2-4 cm. long, glabrous, more or less parallel-veined. Capsule usually oblongoid, 4- to 6-valvate, prominently spinose; seeds many, from 4-6 parietal placentae, globose, reticulate, glabrous.

Southern United States and Mexico to Argentina and Chile; West Indies. Naturalized into Old World.

COLÓN: Santa Rita trail, Cowell 114.

Nine additional specific synonyms are listed by 'Kew Index' for this species; also quite a number of untenable or doubtfully tenable varieties and subvarieties have been proposed by Fedde and others. Probably critical study of the genus would indicate still other synonyms for this early name.

The TOVARIACEAE probably are represented in Panama by *Tovaria pendula* R. & P., although it has not yet been collected there. The species is known to extend from southern Mexico to Peru.

The MORINGACEAE are represented in Panama by *Moringa oleifera* Lam., the "Horseradish Tree" or *marango*. A native of Africa and the Netherlands East Indies, the species is commonly planted for hedges and ornamental trees. The seeds are utilized in the production of ben oil, of commercial value as a lubricant of watches and other delicate mechanisms. The English vernacular name arises from the flavor and odor of the roots.

CAPPARIDACEAE

Trees, shrubs, or herbs, frequently with glandular, lepidote, or stellate indument, occasionally spiny; leaves alternate, rarely opposite, simple or palmately compound, frequently 1-foliate, stipulate or exstipulate, usually entire, rarely minutely serrate; inflorescence indeterminate, simple or compound, occasionally reduced to a single flower, bracteate or ebracteate; flowers hermaphrodite or monoecious through abortion, regular or obliquely irregular; sepals usually 4, valvate, imbricate, or open in the bud, occasionally concrecent and rupturing irregularly at anthesis; petals 4, rarely 0, equal or unequal, usually unguiculate, imbricate, valvate, or open in the bud; receptacle usually elongated into a prominent gynophore or androgynophore, frequently with glandular or eglandular disk elaborations; stamens few to many, equal or unequal, more or less declinate as a rule; filaments usually connate at the very base and free or attached to an androgynophore, inflexed or contorted in the bud; anthers 4-celled, dehiscing longitudinally, dorsifixed near the base; ovary usually borne upon a more or less elongate gynophore, occasionally sessile or subsessile, 2-carpellate, 1-celled with 2 parietal

placentas, rarely 2- to 4-celled by false septation; stigma capitate or shortly 2-lobed, sessile or stipitate; ovules campylotropous, usually numerous; fruit a dry siliques dehiscing by 2 valves from a prominent replum, or fleshy and indehiscent or tardily dehiscent and without a definite replum; seeds usually cochleate-reniform, with or without an aril, without endosperm, the embryo arcuate or coiled.

A family predominantly of the tropics of both hemispheres. Beside the genera enumerated below, the genus *Morisonia* may be expected in Panama; it is closely related to *Steriphoma* in the concrescent calyx, but the stamens are included within the flowers, which lack the brilliant orange indument of *Steriphoma*. Although numerous Capparidaceae are woody, none reach sufficient size to produce usable timber. The family is chiefly noted for its production of "capers" (*alcaparras*), which are the pickled flower buds and young fruits of *Capparis spinosa*, and for a few species of *Cleome*, particularly *C. spinosa*, which are cultivated as ornamentals in temperate climates.

- a. Herbs, sometimes suffrutescent; fruit a dry, thin-walled siliques, dehiscing from a distinct, double replum.
- b. Flowers hermaphrodite; replum straight and persistently joined at the apex after dehiscence of the siliques; seeds without an aril..... 1. CLEOME
- bb. Flowers monoecious; replum separating at the apex and contorted after dehiscence of the siliques; seeds arillate..... 2. PODANDROGYNE
- aa. Shrubs and trees; fruit fleshy and tardily dehiscent or indehiscent, without a distinct replum.
 - b. Flowers with 4 distinct sepals.
 - c. Leaves compound, 3-foliate; flowers hermaphrodite or unisexual by abortion; disc thick and conspicuous..... 3. CRATAEVA
 - cc. Leaves apparently simple, 1-foliate; flowers hermaphrodite; disc thin and inconspicuous..... 4. CAPPARIS
 - bb. Sepals concrescent, rupturing irregularly at anthesis..... 5. STERIPHOMA

1. CLEOME L.

CLEOME L. Sp. Pl. 671. 1753.

Pedicellaria Schrank in Roem. & Usteri, Mag. f. Bot. 3:10. 1788.

Gynandropsis DC. Prodr. 1:237. 1824, in major part.

Podogyne Hoffmssgg. Verz. Pfl. Nachtr. 185. 1840. (For other generic synonyms cf. Dalla Torre & Harms, Gen. Siph. 192. 1901.)

Herbs, sometimes suffrutescent, rarely clambering, frequently glandular-pubescent or thorny; leaves alternate, stipulate or exstipulate, usually palmately compound, occasionally simple, the leaflets entire or minutely callose-serrulate; inflorescence racemose, terminal or both terminal and lateral, few- to many-flowered, bracteate, rarely ebracteate; calyx deeply 4-parted, persistent or deciduous; petals 4, more or less unequal, usually unguiculate; disc usually present, symmetrical or asymmetrical, rarely absent; stamens 6, rarely 4, inserted on a short or more or less elongate androgynophore, occasionally nearly sessile, the filaments more or less unequal and declinate; ovary borne upon a more or less elongate gynophore, rarely nearly sessile, the stigma sessile or stipitate, the ovules numerous; fruit a dry, terete siliques, dehiscing from the persistently joined replum by 2 valves; seeds cochleate-reniform, smooth, minutely tuberculate, or transversely rugose.

Fig. 45. *Cleome longipes*

- a. Large clambering thorny subshrubs; fruiting gynophores several times longer than the pedicels; seeds irregularly subquadroid; flowers with a conspicuous disc persisting in the fruit..... 1. *C. LONGIPES*
- aa. Erect or ascending annual herbs; fruiting gynophores shorter than the pedicels to somewhat longer; seeds cochleate-reniform.
 - b. Plants armed with stout spines at the nodes and occasionally upon the petioles.
 - c. Plants relatively stout, conspicuously glandular-pubescent; leaflets 5-7; flowers relatively large, pink, occasionally white; fruiting gynophores about as long as the pedicels..... 2. *C. SPINOSA*
 - cc. Plants relatively slender, inconspicuously pubescent; leaflets 3-5, the lowermost frequently 1; flowers relatively small, green to greenish-purple; fruiting gynophores much shorter than the pedicels..... 3. *C. PANAMENSIS*
 - bb. Plants unarmed.
 - c. Flowers with a conspicuous glandular disc persisting in fruit.
 - d. Fruiting gynophores longer than the pedicels..... 4. *C. PUBESCENS*
 - dd. Fruiting gynophores shorter than the pedicels..... 5. *C. PILOSA*
 - cc. Flowers without a glandular disc, or the disc not well manifest and not obvious in fruit.
 - d. Inflorescence with foliaceous bracts; fruiting gynophores well manifest.
 - e. Plants relatively stout; leaflets 5-9; flowers large and showy with a conspicuous androgynophore; seeds smooth or irregularly tuberculate..... 6. *C. SPECIOSA*
 - ee. Plants relatively slender; leaflets 3; flowers rather small, without a conspicuous androgynophore; seeds very strongly transverse-rugose..... 7. *C. CILIATA*
 - dd. Inflorescence without bracts, or the bracts extremely reduced; fruiting gynophores nearly obsolete..... 8. *C. SERRATA*

1. *CLEOME LONGIPES* Lamb. ex DC. *Prodr.* 1:239. 1824.

Cleome scandens Ruiz ex Eichl. in *Mart. Fl. Bras.* 13¹:251. 1865, nom. nud. in synon.

Giant suffrutescent herbs; stems as much as 8 m. tall and 2-3 cm. in diameter at the base, trailing or clambering over neighboring plants, inconspicuously pilosulose to glabrate, armed with yellow thorns which are paired and particularly prominent at the nodes; leaves alternate, petiolate, palmately compound, the petioles 2-8 cm. long, armed with stout yellow thorns, the leaflets 3-5, ovate-elliptic, acute, cuneate, 2.5-8.0 cm. long, 1-3 cm. broad, essentially glabrous, but the midrib beneath frequently armed with thorns similar to those of the petiole; inflorescence a dense, terminal, many-flowered raceme 5-15 cm. long, the peduncle minutely pilosulose and frequently armed with small thorns, greatly accrescent in fruit, the bracts minute and setose, or suppressed, the pedicels about 1 cm. long; sepals 4, ovate-lanceolate, narrowly acuminate, about 3-4 mm. long, papillate; petals broadly elliptic, 6-8 mm. long, greenish, unguiculate, the narrow claw about $\frac{1}{3}$ as long as the blade; stamens 6, the filaments about 5 mm. long, inserted near the base of the androgynophore, the anthers about 3 mm. long; disc conspicuous, glandular, concentric, about 1.5 mm. in diameter; ovary about 1.5 mm. long, glabrous, the stigma sessile, the gynophore about 1 mm. long, very greatly accrescent in fruit; siliques linear-fusiform, 8-20 cm. long, about 1.5 mm. thick, irregularly moniliform, glabrous, seeds roughly subquadroid, about 1 mm. square, brownish-granulose, the fruiting gynophores 25-30 cm. long, pendulous.

Costa Rica to Peru.

BOCAS DEL TORO: Changuinola valley, *Dunlap* 584, 333; Nieveleta, *Woodson & Schery* 1025. DARIÉN: Tucuti, Chepigana Distr., *Terry & Terry* 1399; Marraganti, *Williams* 639.

2. CLEOME SPINOSA Jacq. *Enum. Pl. Carib.* 26. 1760.

Cleome heptaphylla L. *Sp. Pl.* ed. 2. 937. 1763.

Cleome pungens Willd. *Hort. Berol.* t. 18. 1803.

Cleome horrida Mart. ex Roem. & Schult. *Syst.* 7:32. 1829.

Cleome spinosa var. *horrida* (Mart.) Fawc. & Rendle, *Fl. Jam.* 3:226. 1914.

Relatively stout herbs as much as 1.5 m. tall; stems conspicuously glandular-pubescent, armed with prominent paired thorns at the nodes; leaves alternate, petiolate, palmately compound, the petioles 2-8 cm. long, glandular-pubescent and usually armed with rather stout, yellow thorns, the leaflets 5-7, elliptic-ob lanceolate, acute, narrowly cuneate, 2-10 cm. long, conspicuously pubescent and the midribs occasionally aculeolate beneath; inflorescence a many-flowered, corymbose raceme, the peduncle densely glandular-pubescent, greatly elongating in fruit, the bracts foliaceous, sessile and more or less cordate, 0.1-3.0 cm. long, the pedicels about 2 cm. long, glandular-puberulent; sepals 4, oblong-elliptic, acuminate, about 5-8 mm. long, densely glandular-puberulent; petals obovate-spatulate, 1-2 cm. long, unguiculate, the claw about $\frac{1}{4}$ as long as the blade, bright pink, occasionally white; stamens 6, the filaments attached somewhat above the base of the androgynophore, somewhat longer than the petals, the anthers about 8 mm. long; disc very inconspicuous, not obvious in fruit; ovary about 3 mm. long, glabrous, the stigma sessile, the gynophore about 2 cm. long, somewhat accrescent in fruit; siliques narrowly fusiform, 5-12 cm. long, about 2-4 mm. thick, continuous or slightly moniliform, glabrous or somewhat glandular-puberulent; seeds cochleate-reniform, about 2 mm. long, light buff, smooth or minutely tuberculate; fruiting gynophores 2-3 cm. long, about equaling the pedicels or slightly longer, somewhat deflexed.

Widely distributed in tropical America and frequently cultivated as an ornamental annual in temperate latitudes.

COLÓN: vicinity of Colón, Cowell 95.

It is hard to tell whether the specimen cited is indigenous or an escape from cultivation.

3. CLEOME PANAMENSIS Standl. in *Jour. Wash. Acad. Sci.* 17:252. 1927.

Cleome Houstoni of several authors, not R. Br.

Rather weak annual herbs as much as 6 dm. tall; stems inconspicuously pubescent to essentially glabrous, usually armed with rather inconspicuous, paired thorns at the nodes; leaves alternate, the upper palmately compound, the lowermost frequently simple, the petioles 2-7 cm. long, sparsely pilosulose to essentially glabrous, usually bearing rather sparse, inconspicuous spines, the leaflets 3-5, rather broadly elliptic, narrowly acuminate, cuneate, 2-7 cm. long, essentially glabrous, the midrib infrequently with minute spines beneath; inflorescence a few- to several-flowered raceme, the peduncle minutely puberulent, elongate in fruit, the bracts foliaceous, 0.2-1.5 cm. long, distinctly stipitate, the pedicels 1.0-1.5 cm. long, very slender, minutely puberulent-papillate; sepals 2-3 mm. long, lanceolate,

minutely glandular-puberulent; petals green to greenish-purple, 3–6 mm. long, unguiculate, the claw about $\frac{1}{3}$ as long as the blade; stamens 6, the filaments attached at the base of the androgynophore, about 2 mm. long, the anthers about 3–4 mm. long; disc clearly manifest, persisting in fruit; ovary about 3 mm. long, glabrous or minutely papillate, the stigma borne upon a rather slender style persisting in fruit, the gynophore about 1 mm. long, accrescent in fruit; siliques narrowly fusiform, 3–6 cm. long, about 2 mm. thick, rather obscurely moniliform, glabrous; seeds cochleate-reniform, yellow-buff, about 1.5 mm. long, smooth or very minutely granulose; fruiting gynophores much shorter than the pedicels, about 5 mm. long.

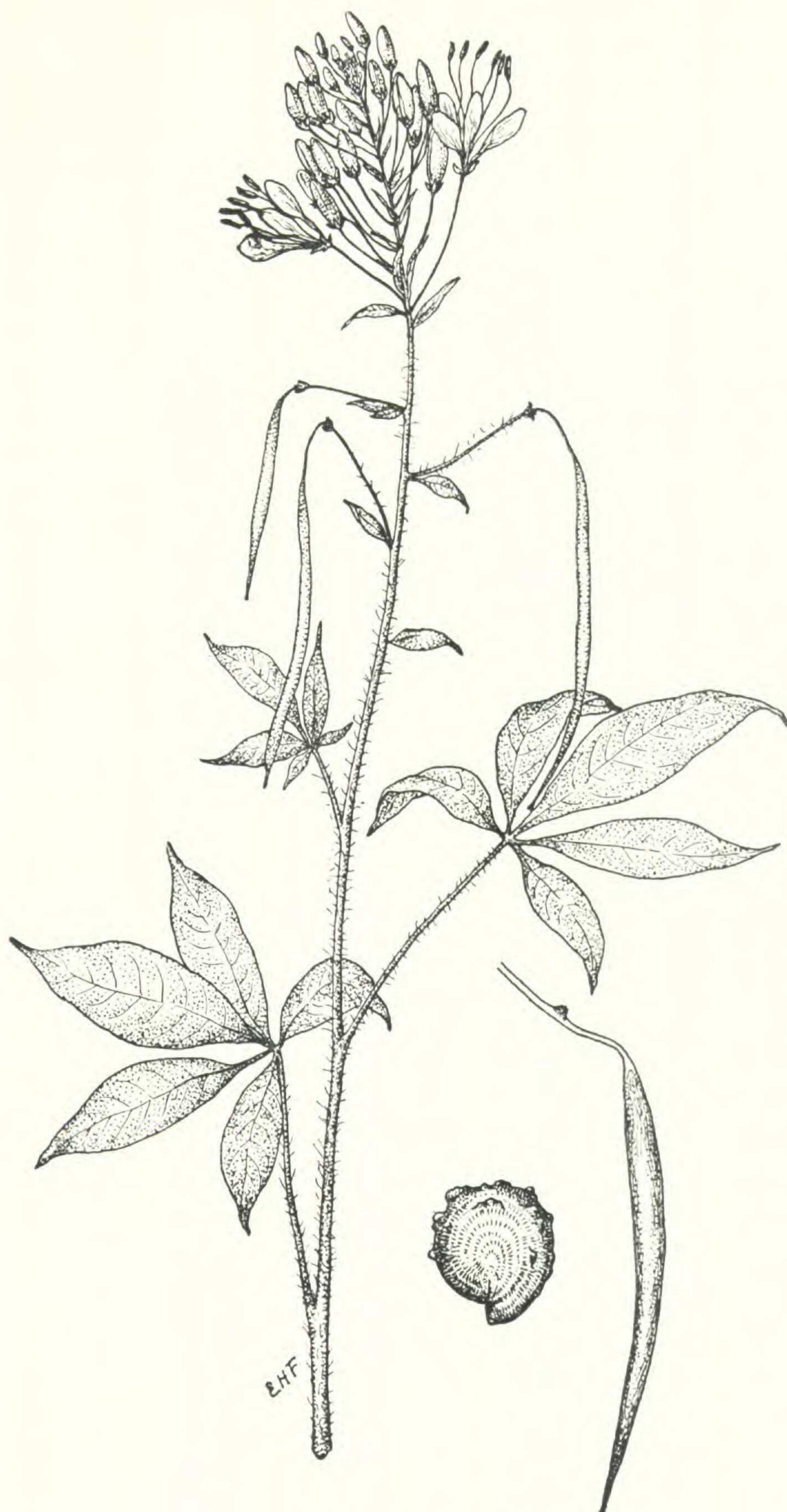
Known with certainty only from Panama, but possibly extending into Colombia.

CANAL ZONE: Frijoles, Pittier 3751; Margarita Swamp, south of France Field, Maxon & Valentine 7066; Miller Pt., Barro Colorado Island, Aviles 993; end of Pearson Trail, Barro Colorado Island, Bangham 576. DARIÉN: Marraganti, Williams 993.

The interpretation of this species has been somewhat difficult. In describing it, Standley allied it to *C. aculeata*, which he noted to differ in having coarsely tuberculate seeds. *C. aculeata* also differs in having a sessile stigma and in the absence of a manifest disc. My interpretation of *C. panamensis* includes specimens previously included under *C. Houstoni* by Standley (Fl. Panama Canal Zone, 185. 1928). This species of the Antilles differs from *C. panamensis* in its stouter, more viscid-glandular habit, its longer fruiting gynophores, its more strongly developed disc, and its larger, bright pink flowers.

4. *CLEOME PUBESCENS* Sims in Curt. Bot. Mag. t. 1857. 1816.

Rather stout herbs as much as 1.5 m. tall; stems densely glandular-pubescent to essentially glabrous, unarmed; leaves alternate, palmately compound, the petioles 7–15 cm. long, pilose, the leaflets 5–7, elliptic to oblanceolate-elliptic, acuminate, narrowly cuneate, 5–14 cm. long, essentially glabrous or minutely glandular-puberulent beneath; inflorescence a many-flowered raceme, the peduncle densely glandular-puberulent, greatly elongate in fruit, the bracts foliaceous, distinctly petiolate, the uppermost about 2 mm. long, grading downward to the foliage leaves, the pedicels about 1.5 cm. long, densely glandular-puberulent, accrescent in fruit; sepals about 3 mm. long, ovate, acuminate, sparsely glandular-puberulent; petals pink or white, obovate, about 1.5 cm. long, sessile; stamens 6, the filaments very unequal, attached somewhat above the base of the androgynophore, 1.5–2.0 cm. long, the anthers about 5 mm. long; disc very distinct and glandular, eccentric, persisting in fruit; ovary about 5 mm. long, minutely puberulent-papillate, the stigma nearly sessile, the gynophore about 1 cm. long, greatly accrescent in fruit; siliques narrowly fusiform, 5–10 cm. long, about 3–5 mm. thick, continuous, minutely and rather sparsely puberulent; seeds cochleate-reniform, about 1.5 mm. long, brown, minutely and rather sparsely tuberculate; fruiting gynophores longer than the pedicels, 4–5 cm. long, essentially straight.

Fig. 46. *Cleome pilosa*

Costa Rica to Brazil; Dominican Republic.

DARIÉN: Boca de Pauarandó, Sambú River, alt. 20 m., *Pittier* 5586. VERAGUAS: Isla de Uva, Contreras group, *Pittier* 5514.

5. CLEOME PILOSA Benth. Bot. Voy. Sulphur 65. 1844.

Cleome pilosa var. *costaricensis* Donn. Sm. in Bot. Gaz. 23:235. 1897.

Cleome Pittieri Briq. in Ann. Cons. & Jard. Bot. Genève 17:370. 1914.

Rather stout herbs as much as 1.5 m. tall; stems glandular-pubescent, unarmed; leaves alternate, palmately compound, the petioles 5–25 cm. long, pilose, the leaflets 5–10, or the uppermost 3, oblanceolate-elliptic, subcaudate-acuminate, narrowly cuneate, 3–25 cm. long, 1–5 cm. broad, either surface with sparse, strigose hairs; inflorescence a many-flowered raceme, the peduncle densely glandular-puberulent, greatly elongate in fruit, the bracts foliaceous, petiolate, grading to the uppermost foliage leaves, the pedicels 1.5–2.0 cm. long, densely glandular-puberulent, accrescent in fruit; sepals ovate, acuminate, 2–3 mm. long, glandular-papillate; petals pink or pinkish-lavender, obovate, 1.0–1.5 cm. long, sessile; stamens 6, the filaments 1.0–1.5 cm. long, attached somewhat above the base of the androgynophore, the anthers about 5 mm. long; disc very prominent and eccentric, persisting in fruit; ovary about 5 mm. long, papillate, the gynophore 0.5–1.0 cm. long, accrescent in fruit; siliques narrowly fusiform, 6–10 cm. long, glabrous; seeds cochleate-reniform, about 1.5 mm. long, yellowish buff, smooth or inconspicuously tuberculate; fruiting gynophores shorter than the pedicels, 1–2 cm. long.

Southern Mexico to Colombia and Venezuela.

BOCAS DEL TORO: Lincoln Creek, Changuinola valley, *Dunlap* 573. CANAL ZONE: along Chagres River, between Gamboa and El Vigía, *Pittier* 2366; between Gorgona and Mamei, alt. 10–30 m., *Pittier* 2250; vicinity of Madden Dam, alt. 50–75 m., *Seibert* 558; Río Paraíso, above East Paraíso, *Standley* 2985; Madden Dam, *Porterfield* s. n.; near Alhajuela, *Killip* 3216; forests on dry limestone, around Alhajuela, alt. 30–100 m., *Pittier* 2366.

C. pilosa and *C. pubescens* are distinguishable almost solely by the relative lengths of the fruiting pedicels and gynophores, and it may well be doubted that they are sufficiently separated as species.

6. CLEOME SPECIOSA HBK. Nov. Gen. & Sp. 5:84. t. 436. 1821.

Gynandropsis speciosa (HBK.) DC. Prodr. 1:238. 1824.

Stout herbs 1 m. or more tall; stems sparsely pilosulose to essentially glabrous, unarmed; leaves alternate, palmately compound, the petioles 2–12 cm. long, irregularly pilosulose to essentially glabrous, the leaflets 5–9, or the uppermost 3, oblanceolate, acuminate, very narrowly cuneate-decurrent, 5–25 cm. long, 1–4 cm. wide, sparsely pilosulose to glabrous; inflorescence a several- to many-flowered, corymbiform raceme, the peduncle somewhat accrescent in fruit, the bracts foliaceous, sessile, cordate, grading to the uppermost leaves, the pedicels 3–4 cm. long, sparsely pilosulose to glabrous, somewhat accrescent in fruit; sepals ovate, long-acuminate, 4–5 mm. long, sparsely pilosulose; petals oblanceolate-spatulate,

2.5–3.5 cm. long, bright pink or rose-purple, unguiculate, the claw about $\frac{1}{4}$ as long as the blade; stamens 6, the filaments 3–5 cm. long, attached about 5–7 mm. above the base of the androgynophore, the anthers 7–8 mm. long; disc absent or obsolete; ovary about 1 cm. long, minutely papillate, the stigma nearly sessile, the gynophore 2.0–2.5 cm. long, accrescent in fruit; siliques 6–10 cm. long, about 2 mm. thick, continuous or obscurely moniliform, glabrous; seeds cochleate-reniform, dark brown, about 2.5 mm. long, prominently but irregularly tuberculate; fruiting gynophores much longer than the pedicels, 3–5 cm. long.

Southern Mexico to northern South America.

CANAL ZONE: vicinity of Gatuncillo, *Piper* 5644; Paraíso, *Hayes* 107. PANAMÁ: Capira, *Paul* 129.

The genus *Gynandropsis* is not recognized in this treatment since it is quite impossible for us to distinguish it from *Cleome* in the phraseology adopted by certain recent floras. In no species of *Cleome* known to us can the staminal filaments truthfully be described as "free from the gynophore." In some species, the attachment of the stamens is quite at the base of the gynophore, but in others, as in *C. spinosa*, *C. pubescens*, and *C. pilosa*, as well as in many others outside Panama, an androgynophore only slightly shorter than that of *C. speciosa* is present, and may be seen quite clearly in fruiting specimens.

7. CLEOME CILIATA Schum. & Thonn. in Dansk. Vidensk. Selsk. Skr. Nat. & Mat. Afh. 4:68. 1829.

Cleome guineensis Hook. f. in Hook. Niger Fl. 218. 1849.

Rather slender herbs less than 1 m. tall; stems sparsely and inconspicuously pilosulose to glabrous, unarmed; leaves alternate, palmately compound, the petioles 2–4 cm. long, sparsely pilosulose to glabrate, the leaflets 3, rhombic-elliptic, acute, cuneate, 1.5–4.0 cm. long, sparsely pilosulose to essentially glabrous; inflorescence a few-flowered raceme, the bracts 3-foliolate and grading to the uppermost leaves, or the uppermost entire, the pedicels about 2 cm. long, essentially glabrous, slightly accrescent in fruit; sepals narrowly lanceolate, acuminate, about 4 mm. long, sparingly glandular-puberulent; petals oblanceolate-spatulate, pink, about 8 mm. long, unguiculate, the claw about $\frac{1}{4}$ as long as the blade; stamens 6, the filaments very unequal, 4–6 mm. long, the lower half somewhat thickened, attached to the base of the gynophore, the anthers about 2 mm. long; ovary 4–5 mm. long, rather sparsely glandular-papillate, the stigma distinctly stipitate, the gynophore about 2 mm. long, accrescent in fruit; siliques about 4 cm. long, about 3 mm. thick, continuous, glabrous; seeds cochleate-reniform, orange-buff, very strongly transverse-rugose, about 1.5 mm. long; fruiting gynophore much shorter than the pedicels, about 5 mm. long.

Western tropical Africa; introduced into Jamaica, Trinidad, and Panama.

CANAL ZONE: Matachin to Las Cascadas, *Cowell* 332.

The first record of this species for continental America.

8. CLEOME SERRATA Jacq. Enum. Pl. Carib. 26. 1760.

Cleome polygama L. Sp. Pl. ed. 2. 939. 1763.

Rather slender herbs seldom attaining 1 m. in height; stems essentially glabrous, unarmed; leaves palmately compound or the lower simple, the petioles 3–6 cm. long, scattering pilosulose to glabrous, the leaflets 3–1, lanceolate to ovate, acuminate, obtuse at the base, 3–15 cm. long, 1–6 cm. broad, minutely callose-serrulate, essentially glabrous; inflorescence a rather few-flowered raceme, the peduncle essentially glabrous, somewhat elongated in fruit, the bracts setose and caducous or obsolete, the pedicels 1.0–1.5 cm. long, essentially glabrous, somewhat accrescent in fruit; sepals ovate-lanceolate, acuminate, 4–5 mm. long, glabrous; petals elliptic-ob lanceolate, about 8 mm. long, pale purple or greenish to white; stamens 6, the filaments 5–7 mm. long, attached somewhat above the base of the androgynophore, the anthers about 4 mm. long; disc obsolete; ovary about 5–6 mm. long, glabrous, the stigma sessile, the gynophore about 2 mm. long, not elongating in fruit; siliques about 4–8 cm. long, about 3 mm. thick, glabrous; seeds cochleate-reniform, dark brown, conspicuously tuberculate, about 2 mm. long.

Southern Mexico to Colombia; Cuba and Jamaica.

CANAL ZONE: near Corozal, *Gervais* 146. COLÓN: between France Field and Catival, *Standley* 30433; around Porto Bello, alt. 5–100 m., *Pittier* 2472. DARIÉN: Marraganti, *Williams* 656; Yape, alt. 30 m., *Allen* 852. PANAMÁ: between Las Sabanas and Matías Hernández, *Standley* 31924.

2. PODANDROGYNE Ducke

PODANDROGYNE Ducke in *Archivos Jard. Bot. Rio* Jan. 5:115. 1930.

Gynandropsis DC. *Prodr.* 1:237. 1824, in part.

Erect or ascending, suffrutescent or suffruticose herbs; leaves alternate, simple or palmately compound, exstipulate; inflorescence racemose or corymbose, terminal, several- to many-flowered, bracteate or ebracteate; flowers monoecious, or occasionally dioecious through abortion, the lower flowers pistillate, the upper staminate; calyx more or less deeply 4-parted, persistent or deciduous, sometimes more or less petaloid; petals 4, more or less unequal, usually unguiculate; disc usually manifest, symmetrical or eccentric; fertile stamens 6, inserted on a short or moderately elongate androgynophore, the filaments somewhat unequal and declinate, the anthers dorsifixed near the base, accompanied by an abortive, nearly sessile pistillode; fertile ovary borne upon a manifest gynophore of moderate length, the stigma capitate, shortly stipitate, the ovules numerous, the accompanying staminodia borne upon a manifest androgynophore, greatly reduced, sagittate; fruit a dry, terete siliques, dehiscing irregularly, the replum finally separating at the tip and irregularly contorted; seeds cochleate-reniform, smooth or granulate, with a conspicuous, lamellate, funicular aril.

1. *PODANDROGYNE CHIRIQUENSIS* (Standl.) Woodson, comb. nov.

Gynandropsis chiriquensis Standl. in Jour. Wash. Acad. Sci. 17:252. 1927.

Gynandropsis pulcherrima Standl. loc. cit. 253. 1927.

Suffruticose herbs 1–3 m. tall, the stem simple or branching, more or less conspicuously ferruginous-pilosulose to essentially glabrous; leaves alternate, long-petiolate, palmately compound or the uppermost rarely simple, the petioles 2–20 cm. long, inconspicuously pilosulose to essentially glabrous, the leaflets 3–7, shortly petiolulate, elliptic to obovate, acuminate, cuneate, the median largest, 4–20 cm.



Fig. 47. *Podandrogyné chiriquensis*

long, 1–9 cm. broad, glabrous above, finely puberulent to essentially glabrous beneath; inflorescence a simple, dense, several- to many-flowered, terminal corymb, the peduncle 3–8 cm. long, finely ferruginous-puberulent, the pedicels 1–2 cm. long, the bracts apparently completely suppressed; flowers monoecious or sometimes apparently dioecious, the lower pistillate, the upper staminate; calyx 0.6–1.0 cm. long, the lobes free nearly to the base, lanceolate, acuminate, minutely papil-

late, green or somewhat petalaceous; petals ovate-spatulate, unguiculate, 0.8–1.8 cm. long, brilliant red or reddish-orange, the claw about $\frac{1}{3}$ as long as the blade; fertile stamens widely exserted, the filaments 2–3 cm. long, glabrous, the anthers about 0.5 cm. long, the androgynophore 1–3 mm. long; fertile pistil oblong-fusiform, 1.0–1.5 cm. long, densely papillate, the capitate stigma borne upon a short style, the gynophore 2–3 mm. long, elongating after pollination, the staminodia about 2 mm. long; siliques pendulous, linear-fusiform, 4–13 cm. long, about 4 mm. broad, continuous, glabrous, the fruiting gynophore 1.0–2.5 cm. long, the seeds pale ashy brown, indistinctly granulate, about 3 mm. long.

Costa Rica to Panama.

BOCAS DEL TORO: Buena Vista, Cooper 220. CHIRIQUÍ: valley of the upper Río Chiriquí Viejo, alt. 1300–1900 m., Seibert 138, G. White 168; vicinity of Cerro Punta, alt. 2000 m., Allen 1560, White & White 50; Bajo Chorro, Boquete Distr., alt. 6000 ft., Davidson 180; vicinity of Bajo Mona and Quebrada Chiquero, alt. 1500 m., Woodson & Schery 539; along Río Caldera below Quiel, Pittier 3145; Casita Alta, Volcán de Chiriquí, alt. 1500–2000 m., Woodson, Allen & Seibert 859; valley of upper Río Gariché, alt. 1050–1100 m., Seibert 334. COCLÉ: La Mesa, along trails in cleared areas, Allen 2730; vicinity of El Valle, north rim, alt. 800–1000 m., Allen 219; mountains beyond La Pintada, alt. 400–600 m., Hunter & Allen 552.

The several specimens enumerated above, as well as several not cited, may be separated in general into two groups with leaflets three or five, coinciding with Standley's primary distinction of *Gynandropsis pulcherrima* and *G. chiriquensis*, respectively. In intervening specimens, however, the leaflets may be from three to five upon the same stem, or as many as seven.

3. CRATAEVA L.

CRATAEVA L. Sp. Pl. 444. 1753.

Tapia Adans. Fam. 2:407. 1763. (For other generic synonyms cf. Dalla Torre & Harms, Gen. Siph. 192. 1901.)

Shrubs or small trees, usually glabrous; leaves alternate, palmately 3-foliate, exstipulate; inflorescence terminal, several-flowered, corymbosely racemose; flowers hermaphrodite or unisexual through abortion; calyx deeply 4-parted, imbricate, deciduous; petals 4, open in the bud, long-ungulate; disc radially symmetrical, thick and conspicuous, adnate to the calyx tube; stamens 8–50, the filaments inserted on a short androphore; ovary borne upon an elongate gynophore, ovoid or spherical, the stigma sessile, the ovules numerous, borne upon 2 parietal placentas; fruit an indehiscent, ovoid or spherical berry borne upon an elongate, thickened gynophore.

1. CRATAEVA TAPIA L. Sp. Pl. 444. 1753.

Cleome arborea Schrad. in Goett. Gel. Anz. 707. 1821.

Crataeva gynandra L. loc. cit. ed. 2. 636. 1762.

Crataeva tapioides DC. Prodr. 1:243. 1824.

Crataeva acuminata DC. loc. cit. 1824.

Crataeva radiatiflora DC. loc. cit. 1824.

Crataeva Benthamii Eichl. in Mart. Fl. Bras. 13¹:265. 1865.

Fig. 48. *Crataeva Tapia*

Shrubs or trees to 10 m. or more tall, with grayish bark conspicuously lenticellate; leaves somewhat caducous, long-petiolate, 3-foliate, the leaflets elliptic, acute to acuminate, obtuse or attenuate at the base, 5–20 cm. long, 1.5–8.0 cm. broad, membranaceous, glabrous or irregularly puberulent-papillate, the petiole 2–9 cm. long; inflorescence terminal, corymbose, several-flowered, somewhat exceeding the subtending leaves, the pedicels 4–8 cm. long; sepals ovate-trigonal and acuminate to obovate-elliptic and obtuse, 3–4 mm. long, glabrous; petals long-ungulate, 1.5–2.5 cm. long, white or greenish, the blade narrowly elliptic to broadly obovate; stamens variable in number, usually 16, the filaments somewhat unequal, 2–6 cm. long, glabrous, the anthers 3–4 mm. long; pistil spherical or

broadly ovoid, 3-5 mm. long, the gynophore 2-4 cm. long; mature fruit spherical or ovoid, 3-7 cm. long, the gynophore 5-7 cm. long.

CANAL ZONE: around Alhajuela, Chagres valley, alt. 30-100 m., Pittier 3455. CHIRIQUÍ: Puerto Armuelles, alt. 50 ft., Davidson 1104; Progreso, Cooper & Slater 238; along Río Dupí, near sea level, Pittier 5218. COCLÉ: Natá, Seemann s. n.

Called *estrella* in Chiriquí, according to Cooper and Slater. Known as "Garlic Pear Tree" in Jamaica, according to Fawcett and Rendle, because of the fetid odor of garlic emitted by all parts of the plants, including the wood, which is rather soft and coarse.

4. CAPPARIS L.

CAPPARIS L. Sp. Pl. 503. 1753.

Quadrella Meissn. Gen. 15. 1837. (For numerous other synonyms cf. Dalla Torre & Harms, Gen. Siph. 193. 1901.)

Shrubs or trees, glabrous, lepidote, or pubescent with stellate or simple hairs; leaves usually alternate, stipulate or exstipulate, the blade simple, sometimes subtended by a more or less definite petiolar pulvinus; inflorescence various, usually several- to many-flowered, bracteate; sepals 4, free or somewhat united at the base, valvate, imbricate, or open in the bud, equal or in 2 unequal series, usually subtending a fleshy or membranaceous disc gland; petals 4, equal or somewhat unequal, imbricate or open in the bud; stamens few to over 100, the filaments inserted on a discoid or cylindrical androphore; pistil 1-celled in the Panamanian species, with 2 parietal placentas bearing few to many campylotropous ovules, borne upon a short or elongate gynophore; fruit a fleshy siliques, tardily dehiscent or indehiscent.

- a. Indument lepidote, or of stellate hairs.
- b. Indument lepidote throughout; staminal filaments conspicuously thickened and pilose at the base.
 - c. Ovary and fruit essentially sessile.
 - d. Leaves coriaceous, 4-11 cm. long, rounded to broadly acute, densely lepidote beneath; inflorescence a corymbose panicle..... 1. *C. ODORATISSIMA*
 - dd. Leaves firmly membranaceous, 15-25 cm. long, subcaudate-acuminate, inconspicuously lepidote beneath; inflorescence an elongate raceme..... 2. *C. ANTONENSIS*
 - cc. Ovary and fruit borne upon an elongate gynophore.
 - d. Corymbs clustered in the axils of the uppermost leaves, several-flowered; leaves heavily coriaceous, the petioles 0.5-1.5 cm. long..... 3. *C. CYNOPHALLOPHORA*
 - dd. Corymbs terminal, solitary, few-flowered; leaves firmly membranaceous to subcoriaceous, the petioles 2.0-2.5 cm. long..... 4. *C. CHIRIQUENSIS*
- bb. Indument of stellate hairs upon flowers and leaves, occasionally lepidote upon the stem; staminal filaments glabrous, not greatly enlarged at the base.
 - c. Leaves cuneate at the base.
 - d. Leaves acuminate to subcaudate-acuminate; calyx cleft nearly to the receptacle, the lobes essentially free.
 - e. Corymbs much shorter than the subtending leaves, the flowers not specially congested at the base of the peduncle; flowers very small, the petals about 3.5 mm. long, the gynophore much shorter than the stamens..... 5. *C. CROTONANTHA*

- ee. Corymbs umbelliform, the flowers congested at the tip of a filiform peduncle nearly as long as the subtending leaves; flowers larger, the petals 8–10 mm. long, the gynophore longer than the stamens..... 6. *C. FILIPES*
- dd. Leaves broadly rounded and minutely mucronulate; calyx campanulate, cleft about half way to the receptacle..... 12. *C. OVALIFOLIA*
- cc. Leaves deeply cordate and amplexicaul, densely stellate-tomentose beneath; corymbs subumbelliform, the flowers congested at the tip of a filiform peduncle much exceeding the subtending leaves..... 7. *C. MIRIFICA*
- aa. Indument none, or of simple hairs.
 - b. Sepals large and unequal, closely imbricate in the bud, abscissing shortly after anthesis.
 - c. Leaves obscurely cordate at the base, usually pilosulose with simple hairs, very shortly petiolate; fruit subovoid, 3–6 cm. long, densely tuberculate..... 8. *C. VERRUCOSA*
 - cc. Leaves broadly acute to rounded at the base, glabrous, distinctly petiolate; fruits oblong-siliquiform, compressed, 4–15 cm. long, smooth..... 9. *C. FLEXUOSA*
 - bb. Sepals small, essentially equal, open in the bud, persistent after anthesis.
 - c. Inflorescences of several-flowered racemes in the uppermost leaf-axils; leaves strikingly heteromorphic, the lower larger and definitely petiolate, the uppermost much smaller and sessile or sub-sessile, all with a rather definite pulvinus subtending the blade..... 10. *C. BADUCCA*
 - cc. Inflorescence of solitary flowers in the uppermost leaf-axils; leaves essentially homomorphic, the uppermost somewhat reduced in size, but all definitely petiolate, without a pulvinus..... 11. *C. UNIFLORA*

1. **CAPPARIS ODORATISSIMA** Jacq. Hort. Schoenbr. 1:57. *t. 110.* 1797.

Capparis intermedia HBK. Nov. Gen. & Sp. 5:98. 1821.

Shrubs or trees to 15 m. tall, densely lepidote throughout; leaves shortly petiolate, oval to obovate-elliptic, rounded or broadly obtuse at the tip, rounded to obtuse or broadly acute at the base, 4–11 cm. long, 2–6 cm. broad, coriaceous, glabrous above, densely lepidote beneath, the midrib conspicuously impressed, the petioles 0.5–1.0 cm. long; inflorescence terminal and occasionally lateral as well from the uppermost nodes, corymbosely paniculate, branching repeatedly, several- to many-flowered, somewhat shorter than the subtending leaves; pedicels 0.5–1.0 cm. long; bracts minute, caducous; sepals equal, valvate, forming a smooth spherical bud, oblong-elliptic, acute, 5–7 mm. long, coriaceous, densely lepidote without, subtending small trigonal glands about 1 mm. long; petals imbricate, ovate-elliptic, sessile, 7–8 mm. long, puberulent-papillate within, densely lepidote without, usually greenish white; stamens about 28, subequal, the filaments 7–9 mm. long, enlarged and pilosulose at the base, glabrous above, inserted upon a slender androgynophore somewhat less than 1 mm. long, the anthers about 1.5 mm. long; pistil oblongoid, about 3 mm. long, densely lepidote, the stigma sessile, the gynophore somewhat less than 2 mm. long, not elongating in fruit; fruits oblong-fusiform, occasionally somewhat contorted, about 4–10 cm. long, about 0.5 cm. thick, 1-seeded or if 2–3-seeded sharply articulated, minutely lepidote, without a well-manifest gynophore.

Southern Mexico to Venezuela and Peru; Antilles.

COCLÉ: in sand, La Venta Beach, Muenscher 16313. PANAMÁ: Taboga Island, alt. 0–250 m., Pittier 3535, Woodson, Allen & Seibert 1496.

2. *CAPPARIS antonensis* Woodson, spec. nov.

Arbuscula ca. 3 m. alta; ramulis teretibus crassiusculis juventate minute lepidotis mox glabratis; foliis oblongis vel elliptico-oblongis apice subcaudato-acuminatis basi rotundatis 15–25 cm. longis 3.5–5.5 cm. latis membranaceis supra viridibus glabris subtus inconspicue lepidotis, petiolo ca. 0.5 cm. longo; inflorescentiis in axillis foliorum superiorum racemosis multifloris foliis subaequantibus; floribus ignotis; baccis siliquiformibus sessilibus 4-angularibus ca. 18 cm. longis ca 0.5 cm. crassis minute lepidotis.

Small trees about 3 m. tall; branches terete, rather stout, minutely lepidote but soon becoming glabrate; leaves oblong or elliptic-oblong, subcaudate-acuminate, rounded at the base, 15–25 cm. long, 3.5–5.5 cm. broad, membranaceous, glabrous above, inconspicuously lepidote beneath, the petioles about 0.5 cm. long; inflorescence axillary in the upper leaf axils, racemose, many-flowered, the peduncle about as long as the subtending leaves; flowers unknown; fruits siliquiform, sessile, 4-angled, about 18 cm. long and 0.5 cm. thick, minutely lepidote.

COCLÉ: hills north of El Valle, Jan. 13, 1942, P. H. Allen 2948 (Herb. Missouri Bot. Gard., TYPE).

It is difficult to evaluate the affinities of this species since flowers are unknown. It is unlike any American species available to me for comparison.

3. *CAPPARIS CYNOPHALLOPHORA* L. Sp. Pl. 504. 1753; Fawc. & Rendle, in Jour. Bot. 52:143. 1914.

Capparis siliquosa L. Syst. 1071. 1759.

Capparis jamaicensis Jacq. Enum. Pl. Carib. 23. 1760.

Capparis torulosa Sw. Prodr. 81. 1788.

Capparis emarginata A. Rich. in Sagra, Fl. Cub. 10:28. t. 9. 1843.

Capparis isthmensis Eichl. in Mart. Fl. Bras. 13¹:269. 1865.

Shrubs or small trees to 6 m. tall, the branches densely lepidote to glabrate; leaves elliptic to obovate-oblong, occasionally narrowly lanceolate, apex obtuse to acuminate, base obtuse to rounded, 5–20 cm. long, 1.5–6.0 cm. broad, heavily coriaceous, glabrous above, densely lepidote beneath, the petioles 0.5–1.5 cm. long; inflorescence both terminal and in the axils of the upper leaves, corymbose, the terminal paniculate with few branches, the lateral racemose, much shorter than the subtending leaves, densely lepidote throughout, few- to several-flowered; pedicels about 1 cm. long; sepals valvate, forming a sharply 4-angled bud, equal, ovate, acute, 7–12 mm. long, coriaceous, densely lepidote without, puberulent within, subtending an ovate-trigonal, membranaceous, internal gland about 2 mm. long; petals ovate, broadly acute, sessile, 8–15 mm. long, white to purplish or brownish, densely lepidote without, puberulent within; stamens about 32, the filaments subequal, about 2 cm. long, somewhat thickened and pilose at the base, glabrous above, attached to a thickened androgynophore about 1 mm. tall, the anthers about 5 mm. long; pistil oblong-fusiform, about 2 mm. long, densely lepidote, the stigma sessile, the gynophore about 12 mm. long; elongating in fruit;

Fig. 49. *Capparis chiriquensis*

fruits linear-fusiform, more or less articulated, 15–40 cm. long, about 5–6 mm. thick, densely brown-lepidote, the gynophore 5–8 cm. long.

Southern peninsular Florida, Bahama Islands; Antilles; southern Mexico to Venezuela.

CANAL ZONE: Alajuela, *Heriberto* 7; Victoria Fill, near Miraflores Lake, *Allen* 1760, 1748; vicinity of Salamanca Hydrographic Station, Río Pequení, *Woodson*, *Allen* & *Seibert* 1555. DARIÉN: Patiño, on cliffs along the beach, *Pittier* 6608; vicinity of La Palma, alt. 0–50 m., *Pittier* 5504. PANAMÁ: Swamp on Río Jagua, near El Congor Hill, alt. 2 m., *Hunter* & *Allen* 480; near the big swamp east of the Río Tecúmen, *Standley* 26587.

4. *CAPPARIS chiriquensis* Woodson, spec. nov.

Arbor usque 10 m. alta; ramulis post exsiccationem valde angulatis juventate sparse lepidotis tandem glabratis cortice griseo; foliis alternatis longiuscule petiolatis obovato-ellipticis apice anguste acuminatis basi late acutis ca. 15 cm. longis 5.0–5.5 cm. latis firme membranaceis vel tenuiter coriaceis supra pallide viridibus glabris nervo medio impresso subtus dense lepidotis, petiolis 2.0–2.5 cm. longis; inflorescentiis terminalibus racemosis corymbosis paucifloris pedunculo foliis breviori, pedicellis in fructu 2.5–3.0 cm. longis; floribus ignotis; baccis siliquiformibus lineari-fusiformibus leviter articulatis ca. 40 cm. longis 4 mm. crassis dense brunneo-lepidotis, gynophoro ca. 5 cm. longo.

Trees as much as 10 m. tall; branches strongly angulate in desiccation, sparsely lepidote when young, eventually becoming glabrate, bark grayish; leaves alternate, rather long-petiolate, obovate-elliptic, apex narrowly acuminate, base broadly acute, about 15 cm. long and 5.0–5.5 cm. broad, firmly membranaceous to thinly coriaceous, above pale green, glabrous, the midrib impressed, beneath densely lepidote, the petiole 2.0–2.5 cm. long; inflorescence terminal, corymbosely racemose, few-flowered, the peduncle shorter than the subtending leaves, the pedicels in fruit 2.5–3.0 cm. long; flowers unknown; fruits siliquiform, linear-fusiform, slightly articulated, about 40 cm. long and 0.4 cm. thick, densely brown-lepidote, the gynophore about 5 cm. long.

CHIRIQUÍ: vicinity of Puerto Armuelles, alt. 0–75 m., July 28–31, 1940, *Woodson* & *Schery* 846 (Herb. Missouri Bot. Gard., TYPE).

5. *CAPPARIS CROTONANTHA* Standl. in Field Mus. Publ. Bot. 4:210. 1929.

Slender trees about 8 m. tall, the branches terete, slender, stellate-tomentose when young, becoming glabrate; leaves oval or elliptic, abruptly and rather shortly subcaudate-acuminate, base rather broadly acute, 7–18 cm. long, 2.5–8.0 cm. broad, thinly membranaceous, glabrous above, stellate-puberulent beneath, the petiole about 1 cm. long; inflorescence paniculate, several-flowered, much shorter than the subtending leaves, the pedicels about 0.4 cm. long, brownish stellate-puberulent, the bracts minute, caducous; sepals equal, valvate, closed in the spherical bud, ovate-oblong, broadly acute, about 3 mm. long, finely brown stellate-puberulent, subtending hemispheric, rather fleshy, glabrous glands somewhat less than 0.5 mm. long; petals ovate, sessile, rounded at the tip, about 3.5 mm. long,

white, minutely puberulent with simple hairs; stamens 20, the filaments about 2.5 mm. long, glabrous, not enlarged at the base, attached to an androphore about 0.5 mm. long, the anthers about 1 mm. long; pistil shortly oblongoid, about 1 mm. long, glabrous, the gynophore about 1 mm. long; fruits globose, about 5 cm. in diameter "with hard green rind and white pulp."

Panama.

SAN BLAS: Permé, Cooper 660.

6. *CAPPARIS FILIPES* Donn. Sm. in Bot. Gaz. 23:2. 1897.

Capparis clara Schery, Ann. Missouri Bot. Gard. 29:351. 1942.

Small trees to about 5 m. tall; branches slender, terete, brownish lepidote when young, developing a gray bark when older; leaves oblong- to obovate-elliptic, subcaudate-acuminate, base acute, firmly membranaceous, 8–17 cm. long, 3.5–7.0 cm. broad, glabrous above, inconspicuously stellate-puberulent beneath, the petioles 0.3–0.5 cm. long; inflorescences in the axils of the uppermost leaves, umbelliform at the tip of a filiform naked peduncle 8–10 cm. long, bearing 8–10 small white flowers, the pedicels filiform, 1.5–2.0 cm. long, all minutely stellate-puberulent; sepals open in the bud, equal, trigonal, acute, 1.5–2.0 mm. long, brown stellate-puberulent, without glands; petals obovate-oval, rounded, sessile, 8–10 mm. long, brown-stellate without, puberulent-papillate within; stamens 20, the filaments about 1.0–1.5 cm. long, glabrous, not thickened at the base, attached to an inconspicuous androphore about 0.5 mm. long, the anthers 2 mm. long; pistil oblong-fusiform, the stigma sessile, about 3 mm. long, densely white-stellate, the gynophore about 2.5 cm. long; fruit unknown.

Costa Rica; Panama.

BOCAS DEL TORO: Fish Creek Mountains, vicinity of Chiriquí Lagoon, von Wedel 2235.

7. *CAPPARIS MIRIFICA* Standl. apud Woodson & Schery in Ann. Missouri Bot. Gard. 27:311. 1940.

Small trees about 6 m. tall, the branches terete, rather stout, densely brown stellate-tomentose, becoming glabrate; leaves ovate-oblong, rounded or shortly and abruptly acuminate at the tip, deeply cordate and amplexicaul at the base, 15–18 cm. long, 6.0–9.5 cm. broad, pale green and glabrous above, very densely brown stellate-tomentose beneath, the petiole 4–5 mm. long; inflorescence terminal or subterminal, umbelliform at the tip of a filiform, scurfy-stellate, naked peduncle about 40–50 cm. long, apparently few-flowered, the fruiting pedicels 2.5–3.0 cm. long, inconspicuously brown stellate-puberulent; flowers unknown; fruits siliquiform, linear-fusiform, strongly angulate and obviously constricted, 20–30 cm. long, about 8 mm. thick, finely and densely brown stellate-puberulent, the gynophore about 4 cm. long.

Panama.

CANAL ZONE: vicinity of Salamanca Hydrographic Station, Río Pequení, alt. ca. 80 m., Woodson, Allen & Seibert 1591.

8. *CAPPARIS VERRUCOSA* Jacq. *Enum. Pl. Carib.* 23. 1760.*Capparis laeta* HBK. *Nov. Gen. & Sp.* 5:88. 1821.*Capparis brevipes* Benth. *Bot. Voy. Sulphur* 65. 1844.

Shrub usually 2–3 m. tall, the branches slender, terete, glabrous, with olive-gray bark; leaves very shortly petiolate, obovate-oblong, apex acuminate to obtuse, base obscurely cordate, 4–9 cm. long, 1.5–3.0 cm. broad, firmly membranaceous or subcoriaceous, usually more or less puberulent with simple hairs upon either surface, particularly upon the midrib, infrequently glabrate, the petiole 1–3 mm. long; inflorescence terminal, occasionally in the upper leaf axils as well, corymbose, few-flowered, much shorter than the subtending leaves, the pedicels about 1 cm. long, inconspicuously simple-puberulent; sepals closed in the bud, imbricate in 2 unequal series, coriaceous, reniform, the apex rounded, 4–6 mm. long, glabrous, subtending a low, rim-like gland; petals ovate, obtuse, sessile, 1.2–1.5 cm. long, white, glabrous; stamens about 48, the filaments glabrous, 2.5–3.0 cm. long, not greatly enlarged at the base, the anthers 2 mm. long, attached to an androphore less than 1 mm. tall; pistil oblongoid, about 4 mm. long, glabrous, the stigma depressed, the gynophore about 2 cm. long; fruits subovoid, 3–6 cm. long, densely tuberculate, scarlet or orange, the gynophore 2–3 cm. long.

Southern Mexico to Venezuela.

CANAL ZONE: Alajuela, *Heriberto* 64; forests on dry limestone around Alhajuela, alt. 30–100 m., *Pittier* 3449. DARIÉN: Patiño, on cliffs along the beach, *Pittier* 5701. PANAMÁ: Taboguilla Island, *Miller* 2005.

9. *CAPPARIS FLEXUOSA* L. *Sp. Pl. ed. 2.* 722. 1762.*Capparis cynophallophora* L. *Syst. ed. 10.* 1071. 1759, in part.*Morisonia flexuosa* L. *Amoen. Acad.* 5:398. 1760.

Shrubs or small trees usually 2–8 m. tall, the branches relatively stout, more or less flexuose when young, glabrous, with a brownish bark; leaves extremely variable, from linear to broadly obovate, apex acute to rounded, base obtuse to rounded, 4–15 cm. long, 1–6 cm. broad, subcoriaceous, glabrous, pale green, the venation verrucose on both surfaces, the petioles about 5 mm. long; inflorescence terminal, occasionally also in the uppermost leaf axils, corymbosely paniculate, few-flowered, much shorter than the subtending leaves, the pedicels 0.5–1.0 cm. long; sepals close in the bud, imbricate in 2 unequal series, ovate-reniform, rounded at the tip, 7–10 mm. long, coriaceous, glabrous, the internal gland low and rim-like; petals ovate or obovate, 1.0–1.5 cm. long, white or pale pink, glabrous; stamens well over 100, the filaments normally 6–8 cm. long, rarely only about 1 cm. long, glabrous, not enlarged at the base, attached to a disciform androphore about 4 mm. in diam. and less than 0.5 mm. high, the anthers 2 mm. long; pistil oblongoid, 5–7 mm. long, glabrous, the stigma depressed, the gynophore usually about 6 cm. long, rarely only 1 cm. long; fruits very broadly and irregularly siliquiform and somewhat compressed laterally, 4–15 cm. long, 1.5–2.0 cm. broad, glabrous, red or orange, the gynophore 1–9 cm. long.

Fig. 50. *Capparis flexuosa*

Southern Mexico to Venezuela and Peru; southern peninsular Florida and the Antilles.

PANAMÁ: Trapiche Island, Perlas group, common along rocky beaches, alt. 0-15 m., Allen 2606.

10. CAPPARIS BADUCCA L. Sp. Pl. 504. 1753.

Capparis frondosa Jacq. Enum. Pl. Carib. 24. 1760.

Capparis triflora Mill. Gard. Dict. ed. 8. no. 10. 1768.

Capparis cuneata DC. Prodr. 1:249. 1824.

Capparis stenophylla Standl. in Jour. Wash. Acad. Sci. 13:437. 1923.

Shrubs or small trees 1-5 m. tall, the branches terete, rather slender, glabrous, with greenish gray bark; leaves strikingly heteromorphic, the lower larger and definitely petiolate, the uppermost congested, markedly smaller, and sessile or sub-sessile, oblong-elliptic to ovate, obtuse to acuminate, the base acute to obtuse, 6-20 cm. long, 2-7 cm. broad, dark green, glabrous, the midrib elevated above, the petioles 6 cm. long to essentially obsolete; inflorescences of short, slender, few- to several-flowered racemes in the upper leaf axils, shorter than the subtending leaves, the pedicels about 0.5-0.7 mm. long, glabrous; sepals open in the bud,

ovate-trigonal, acute, about 2 mm. long, glabrous, subtending a low, fleshy gland less than 0.5 mm. high; petals broadly oval, sessile, rounded at the tip, 8–10 mm. long, white, glabrous; stamens about 100, the filaments about 1.5 cm. long, glabrous, not thickened at the base, attached to a discoid androphore about 2 mm. in diameter and less than 1 mm. high, the anthers about 1.5 mm. long; pistil oblongoid, 4 mm. long, glabrous, the stigma depressed, the gynophore about 1 cm. long; fruits irregularly oblong-siliquiform, more or less moniliform, 3–7 cm. long, about 5 mm. thick, glabrous, orange-red, the gynophore about 1.5 cm. long.

Southern Mexico to Brazil and Peru; Antilles.

CANAL ZONE: Barro Colorado Island, Standley 31284, 31298, 31378, 41102, Wilson 34, Frost 106, Maxon, Harvey & Valentine 6822; Río Pedro Miguel, near East Paraíso, moist forest, Standley 29945; vicinity of Gatuncillo, Piper 5621. DARIEN: Marraganti and vicinity, alt. 10–200 ft., Williams 1149. PANAMÁ: Taboga Island, moist thicket, Standley 27872.

11. *CAPPARIS uniflora* Woodson, spec. nov.

Arbor ut dicitur 12 m. alta omnino glaberrima, ramulis crassiusculis cortice griseo bene lenticellato; foliis ellipticis vel obovato-ellipticis apice breviter acuminate basi late acutis 5–9 cm. longis 2.5–4.0 cm. latis membranaceis supra saturate viridibus subtus valde pallidioribus, petiolis 1–2 cm. longis; floribus solitariis in axillis, foliorum superiorum confertis, pedicellis ca. 2.0–2.5 cm. longis; calycis sepalis ut videntur in alabastro apertis subaequalibus trigono-reniformibus apice rotundatis ca. 3 mm. altis foliaceis glabris glandulam subpyramidalem carnosam ca. 2 mm. altam subtendentibus; petalis ovalibus rotundatis sessilibus ca. 1.2 cm. longis coriaceis basi cucullatis glabris extus viridibus intus albis; staminibus ca. 28 filamentis inaequalibus 2.5–4.0 cm. longis glabris basi albis apice purpureis in androphoro ca. 1 mm. alto insertis, antheris ca. 3 mm. longis; pistillo oblongoideo ca. 2 mm. longo glabro stigmate plano, gynophoro ca. 2 cm. longo; fructu ignoto.

Trees said to attain 12 m. in height, glabrous throughout, the branches rather stout with glabrous lenticellate bark; leaves elliptic or obovate-elliptic, apex shortly acuminate, base broadly acute, 5–9 cm. long, 2.5–4.0 cm. broad, membranaceous, dark green above, much paler beneath, the petioles 1–2 cm. long; flowers solitary and gathered in the axils of the uppermost leaves, the pedicels about 2.0–2.5 cm. long; sepals apparently open in the bud, subequal, trigonal-reniform, rounded at the tip, about 3 mm. long, foliaceous, each subtending a fleshy, subpyramidal gland about 2 mm. tall; petals oval, rounded, sessile, about 1.2 cm. long, coriaceous, cucullate at the base, glabrous, green without, white within; stamens about 28, the filaments unequal, 2.5–4.0 cm. long, glabrous, white at the base, purple above, inserted on an androphore about 1 mm. long, the anthers about 3 mm. long; pistil oblongoid, about 2 mm. long, glabrous, the stigma flat, the gynophore about 2 cm. long; fruit unknown.

COCLÉ: trail to Las Minas, north of El Valle, alt. 1000 m., May 10, 1941, P. H. Allen 2460 (Herb. Missouri Bot. Gard., TYPE).

Previously identified as *C. Baducca*, but sharply distinguished by the characters given in the key and descriptions.

12. *CAPPARIS OVALIFOLIA* R. & P. Fl. Peruv. 4: t. 432. 1802.

Capparis avicennifolia HBK. Nov. Gen. & Sp. 5:94. 1821.

Colicodendron avicenniaefolium (HBK.) Seem. Bot. Voy. Herald, 78. 1852.

Shrubs or small trees, the branches terete, relatively slender, densely stellate-canescence; leaves petiolate, oval to oblong-obovate, broadly rounded and minutely mucronulate, cuneate, 4–6 cm. long, 2–3 cm. broad, firmly membranaceous, lustrous and glabrate above, densely stellate-canescence beneath, the petiole about 1 cm. long, densely stellate-canescence; inflorescence terminal, somewhat shorter than the subtending leaves, corymbiform-racemose, bearing several smallish white flowers, densely stellate-canescence throughout, the pedicels about 1 cm. long, the bracts minute, caducous; calyx campanulate, 2.5–3.0 mm. long, the lobes broadly trigonal, about as long as the tube, densely stellate-canescence, each subtending a conspicuous, adnate disk gland of nearly equal length; petals 4, equal, obovate, obtuse, shortly ungulate, 4–5 mm. long, white, glabrate; stamens 20, slightly longer than the petals, the filaments glabrous, inserted upon a low androphore; pistil ovoid, about 3 mm. long, glabrous, the stigmas sessile, the gynophore about 6 mm. long; fruits ovoid-subglobose, about 2.5 cm. in diameter.

Panama to Peru.

DARIÉN: "Isthmus of Darién", *Barclay s. n.*

This species has not been recollected in more than a century since Barclay's visit to Panama. Indeed, it is questionable whether the specimen cited comes from territory at present included within the Republic of Panama, or from the neighboring intendencia of Choco, Colombia.

In addition to the preceding species of *Capparis*, Standley and Steyermark (Fl. Guatemala 4:386. 1946) cite *CAPPARIS INDICA* (L.) Fawc. & Rendle, as occurring in Panama. We have seen no Panamanian specimens of this species, which generally resembles *C. odoratissima* but with the calyx open in the bud, but it is quite likely that it occurs in the republic.

5. STERIPHOMA Spreng.

STERIPHOMA Spreng. Syst. 4: Cur. Post. 130, 139. 1827.

Hermupoa Loefl. Iter Hisp. 307. 1758.

Stephania Willd. Spec. Pl. 2:239. 1799.

Roemera Tratt. Gen. 88. 1802.

Shrubs or small trees, abundantly clothed with orange stellate-pubescece in all parts; leaves alternate, simple, exstipulate; inflorescence racemose, bracteate; sepals concrescent, rupturing into 2–3 irregular lobes at anthesis, somewhat glandular at the base within; petals 4, more or less unequal; stamens 6–8, the filaments attached to a short androphore; pistil borne upon an elongate gynophore, super-



Fig. 51. *Steriphoma macranthum*

ficially 2-celled by the opposed parietal placentas, the ovules numerous, campylotropous; fruit a fleshy dehiscent or indehiscent siliques.

1. **STERIPHOMA MACRANTHUM** Standl. in Jour. Wash. Acad. Sci. 20:183. 1919.

Shrubs or small trees, orange stellate-pubescent in all parts; leaves long-petiolate, ascending, elliptic, narrowly acuminate, base broadly acute, 15–25 cm. long, 5–10 cm. broad, delicately membranaceous, the petioles 6–12 cm. long; inflorescence racemose, many-flowered, the peduncle rather stout, nearly equalling the subtending leaves, the pedicels strongly ascending, 3–4 cm. long; calyx de-clinate, about 1.7–2.0 cm. long; petals apparently about 2.5 cm. long; stamens 8, the filaments 6–8 cm. long, strongly ascending, attached to an androphore less than 0.5 mm. long; pistil oblongoid, about 5 mm. long, the gynophore about equaling the staminal filaments; fruit unknown.

Panama.

DARIÉN: forests around Pinogana, Pittier 6561.

CRUCIFERAE

BY REED C. ROLLINS

Annual, biennial, or perennial herbs; leaves without stipules, alternate, simple or compound, entire to variously lobed or dentate; inflorescence racemose, ebracteate, or the lower flowers subtended by leaf-like bracts; flowers perfect, regular; sepals 4, free, alternating with petals, non-saccate or the outer pair slightly saccate; petals 4, free; stamens usually 6 in two whorls, outer stamens 2, unpaired, usually shorter than paired inner 4; ovary superior, 2-celled with the cells separated by a replum, or rarely 1-celled; style 1, stigma 2-lobed to entire; fruit a siliques, dehiscent or rarely indehiscent.

The Cruciferae are distributed primarily in the temperate latitudes of both hemispheres. The family is sparsely represented in strictly tropical areas. Panama has but few genera and species. Some weedy members of the family not now known from Panama are to be expected in or near cities or agricultural areas.

- a. Siliques linear, many times longer than broad, 1 cm. or more in length.
- b. Siliques dehiscent by valves which open the fruit nearly its entire length.
 - c. Leaves compound; replum margins thickened..... 1. *CARDAMINE*
 - cc. Leaves simple; replum margins not thickened.
 - d. Petals white, minute, less than 5 mm. long..... 2. *ROMANSCHULZIA*
 - dd. Petals yellow, conspicuous, more than 5 mm. long..... 3. *BRASSICA*
 - bb. Siliques without linear valves, jointed and disarticulating near middle..... 4. *CAKILE*
- aa. Siliques short, usually not more than 3 times longer than broad, less than 6 mm. long.
 - b. Siliques terete, not notched at apex..... 5. *RORIPPA*
 - bb. Siliques strongly flattened at right angles to the narrow replum, notched at apex..... 6. *LEPIDIUM*

Fig. 52. *Cardamine ovata*

1. CARDAMINE L.

CARDAMINE L. Sp. Pl. 654. 1753; O. E. Schulz in Bot. Jahrb. 32:280-623. 1903.

Perennial or less frequently annual herbs, pubescent with simple trichomes or glabrous; stems leafy, the leaves petiolate and usually pinnately compound; inflorescence racemose, ebracteate or the lower flowers bracteate; petals spatulate to obovate, white to pink; siliques linear, compressed parallel to the replum, dehiscent by linear, often elastic, valves, tapering at apex to a cylindrical style; stigma usually 2-lobed; seeds emarginate or rarely very narrowly winged.

Cardamine and *Dentaria* are most easily recognized among other linear-podded crucifers by the nature of the opening in the siliques after the valves have dehisced. In these two genera, the replum margin is comparatively thick and extends laterally from the margins to reduce the area covered by the valve. Thus the siliques has a window-like opening. In other crucifers of the same general relationship with linear siliques, the valves cover the entire flattened side of the siliques.

1. CARDAMINE OVATA Benth. Pl. Hartweg. 158. 1839.

Perennial with an underground scaleless rhizome from which the stems arise at short intervals; stems erect or slightly decumbent at base, weak, simple to sparsely branched, striated, glabrous below, glabrous to sparsely pubescent above, 2-6 dm. high; leaves all caudine; petioles glabrous, 2-7 cm. long; leaflets 3-5, elliptical to narrowly ovate, obtuse at apex, cuneate at base, irregularly crenate to shallowly toothed, mucronate, 2-6 cm. long, 1-3 cm. wide, sparsely pubescent with simple trichomes; inflorescence bracteate below, bracts absent above; sepals oblong, pubescent, scarious-margined, 2-3 mm. long, inner pair non-saccate, outer pair slightly saccate; petals white, spatulate to ligulate, 6-10 mm. long; fruiting pedicels divaricately ascending, straight, sparsely pubescent, 1-2.5 cm. long; siliques divaricately ascending, 3-6 cm. long, styles 1-3 mm. long; seeds wingless, oblong, 2-3 mm. long, ca. 1.5 mm. wide.

Costa Rica southward to Peru.

CHIRIQUÍ: Bajo Chorro, Boquete, *Davidson* 201; vicinity of Bajo Chorro, *Woodson* & *Schery* 638; trail from Bambito to Cerro Punta, *Allen* 312; valley of upper Río Chiriquí Viejo, *G. White* 95; Volcán de Chiriquí, *Davidson* 1028, *Killip* 3581, *Pittier* 3123.

2. ROMANSCHULZIA O. E. Schulz

ROMANSCHULZIA O. E. Schulz in Bot. Jahrb. 66:99. 1934.

Annual, biennial, or perennial herbs; pubescence simple; stems single from the base, often coarse, usually branched above, glabrous or pubescent; basal leaves present or absent; caudine leaves sessile, auriculate, sagittate, usually longer than the internodes; inflorescences greatly elongated, terminating many branches as well as the main stem; flowers mostly numerous, small; sepals caducous or at least early deciduous, non-saccate; petals narrow, spreading at anthesis; stamens equal or nearly so, mostly spreading at anthesis, filaments enlarged at base; nectar-glands



Fig. 53. *Romanschulzia costaricensis*

mostly well developed, surrounding or at least subtending all stamens; siliques terete to slightly flattened parallel to replum, erect, widely spreading or deflexed, stipitate to nearly sessile; seeds wingless, plump to somewhat flattened, uniseriate to biseriate; cotyledons incumbent to accumbent.

A single species occurs in Panama.

1. *ROMANSCHULZIA COSTARICENSIS* (Standley) Rollins in Contrib. Dudley Herb. Stanford Univ. 3:219. 1942.

Sisymbrium costaricense Standley in Jour. Wash. Acad. Sci. 17:251. 1927.

Perennial; stems single from the base, glabrous, coarse, branched, 1-1.5 m. high; leaves sessile, oblong to lanceolate or the lower often oblanceolate, acute to nearly obtuse, 6-15 cm. long, 1-3 cm. wide, greenish above, dull beneath, auriculate-clasping, upper smaller and more attenuate than the lower, auricles rather rounded; inflorescences of main stem and branches greatly elongated, very lax; sepals greenish, sometimes purplish-tipped, non-saccate, 2.5-3 mm. long, 1.5 mm. wide; petals narrowly oblong, white to creamy-white, about 2-2.5 mm. long, 0.5 mm. or less in width; filaments 1.5-2 mm. long, anthers about 1.5 mm. long; glandular tissue subtending all filaments, surrounding those of the single stamens; pedicels spreading at right angles to rachis or very slightly ascending, straight or nearly so, glabrous, 3-8 mm. long; mature siliques terete, spreading at right angles to rachis, straight, glabrous, 2-3 cm. long, about 1 mm. broad, shortly stipitate to nearly sessile, gynophore less than 1 mm. long; seeds uniseriate, oblong, wingless, about 1 mm. long, fairly plump; cotyledons accumbent.

Costa Rica and Panama.

CHIRIQUÍ: above El Boquete, Pittier 3058; Bajo Chorro, Boquete, Davidson 447; valley of the upper Río Chiriquí Viejo, G. & P. White I.

3. BRASSICA L.

BRASSICA L. Sp. Pl. 666. 1753; O. E. Schulz, Pflanzenr. IV, 105, Heft 70:21-84. 1919; Bailey, Gentes Herb. 1:53-108. 1922; ibid. 2:211-267. 1930.

Annual or biennial herbs, glabrous or pubescent with simple trichomes; stems usually single from the base, branched above; leaves sessile or petiolate, simple to somewhat divided; inflorescence racemose, ebracteate; sepals oblong to slightly broader, outer pair slightly saccate; petals yellow, spatulate; siliques linear, slightly flattened parallel to replum, usually sterile above and forming a tapering beak; seeds globose or nearly so, wingless; cotyledons conduplicate.

There are no species of *Brassica* native to the Western Hemisphere, but several species and their varieties are grown as vegetables. The two following species are found in Panama as introduced weeds in fields and waste places.

Called *Mostaza* or *Mostacillo*, and cultivated for its edible leaves.

- a. Upper caudine leaves sessile and auriculate; beak and style of mature siliques 1-2 cm. long..... 1. *B. CAMPESTRIS*
- aa. Upper caudine leaves petiolate; beak and style of mature siliques ca. 3-5 mm. long..... 2. *B. INTEGRIFOLIA*

1. *BRASSICA CAMPESTRIS* L. Sp. Pl. 666. 1753.

Annual; stems single from base, glabrous, glaucous, usually branched above, 4–10 dm. high; lower leaves interrupted, often short-petiolate with the expanded base clasping the stem, obovate, 1–2 dm. long, 3–8 cm. wide; upper leaves sessile and clasping, entire or nearly so, oblong, obtuse to rounded at apex; flowers 7–10 mm. long; fruiting pedicels divaricate, 1–2 cm. long, glabrous; siliques divaricate to divaricately ascending, glabrous, 3–5 cm. long, nearly terete to slightly flattened parallel to replum, valves 1-nerved to middle or above; beak and style 1–2 cm. long; seeds dark brown, globose, ca. 1 mm. in diameter.

CHIRIQUÍ: vicinity of El Boquete, Maurice 751.

2. *BRASSICA INTEGRIFOLIA* (Willd.) Rupr. Fl. Ingr. 1:96. 1860.

Sinapis integrifolia Willd. Hort. Berol. pl. 14. 1803.

Annual, glabrous, usually glaucous; stems single from the base, branched above, 5–10 dm. high; lower leaves long-petioled, blade irregularly dentate, oval to broadly obovate, obtuse; upper leaves narrower and shorter-petioled, acute to more or less acuminate, becoming almost entire above; flowers yellow, 7–10 mm. long; inflorescences much elongated; pedicels divaricately ascending, glabrous, about 1 cm. long; siliques erect or ascending, 2–3 cm. long, valves with a prominent mid-vein, beak and style 3–5 mm. long; seeds oval, dark brown, ca. 1 mm. in diameter.

Brassica integrifolia is very closely related to *B. juncea* and may not merit the status of a species. Plants usually determined as *B. integrifolia* have shorter, less torulose siliques and shorter beaks than *B. juncea*. Also, the leaves are irregularly doubly dentate rather than notched as in *B. juncea*.

PANAMÁ: between Corozal and Pedro Miguel, Cowell 402; around Culebra, Pittier 4067.

4. *CAKILE* Mill.

CAKILE Mill. Gard. Dict. ed. 4, 1:118. 1754; O. E. Schulz, Pflanzenr. IV, 105, Heft 84:18–28. 1923.

Annual or biennial herbs, succulent; stems intricately branched, fairly stout, decumbent; leaves fleshy when fresh, entire to nearly pinnate, petioled or sessile, never clasping; inflorescence racemose, ebracteate; flowers white to purplish, petals not conspicuous; inflorescence elongated; pedicels thick; siliques indehiscent, composed of two joints which disarticulate freely at maturity; lower joint turbinate, 1-seeded, upper joint gradually tapering to a beak; seeds oblong, wingless.

1. *CAKILE LANCEOLATA* (Willd.) O. E. Schulz in Urban, Symb. Antill. 3:504. 1903.

Raphanus lanceolatus Willd. Sp. Pl. 3:562. 1800.

Annual; stems coarse, decumbent, 2–6 dm. long, glabrous; leaves with a very slender petiole, narrowly elliptical to linear-ob lanceolate, dentate, acute to obtuse, 3–6 cm. long, glabrous; flowers small, ca. 5 mm. long; petals white; fruiting

pedicels divaricate, thick, 2–4 mm. long; siliques linear, lower joint nearly cylindrical, 3–4 mm. in diameter, 1 cm. or less in length, obscurely nerved; upper joint lanceolate, subterete to slightly flattened toward apex, 1.5–2.5 cm. long; seeds oblong, wingless, plump, ca. 3.5 mm. long, 1.5 mm. wide.

West Indies, South Carolina coast southward to Panama.

COLÓN: along the beach and near sea level, vicinity of Viento Frio, Pittier 4113.

5. RORIPPA Scop.

RORIPPA Scop. Fl. Carn. ed. 1, 520. 1760.

Annual or perennial herbs, glabrous or pubescent with simple trichomes; leaves sessile or petioled, simple to deeply lobed; inflorescence racemose, ebracteate, terminating all the upper branches; flowers small, petals yellow or rarely white; infructescence usually somewhat elongated; siliques short, rarely up to 4 times longer than broad, usually much shorter, terete, plump, valves nerveless; style short, stigma unexpanded.

1. *RORIPPA ISLANDICA* (Oeder ex Murray) Borbás, Balat. Tav. Part. 392. 1900.

Sisymbrium islandicum Oeder ex Murray in Nov. Com. Gött. 3:81. 1773.

Annual or possibly perennial; stems glabrous, striate, branched above, 3–6 dm. high; leaves broadly oblanceolate, obtuse, prominently veined, glabrous, erose or irregularly dentate, lower leaves petioled and often somewhat lobed, 5–10 cm. long, 1–2 cm. wide; upper leaves sessile or short-petioled, lobed or merely erose-margined, less than 5 cm. long; inflorescence congested, elongating in fruit; flowers ca. 2 mm. long, petals yellow; fruiting pedicels divaricate, 2–4 mm. long; siliques terete, ca. 2 mm. in diameter, 3–5 mm. long, glabrous; styles less than 1 mm. long; seeds small, less than 0.5 mm. broad, wingless.

Rorippa islandica is an introduced weed in Panama. The species is native to a wide area in northern North America and northern Europe and is composed of several varieties. It is not certain whether the Panama plants represent one of the European or one of the North American varieties of the species.

BOCAS DEL TORO: along railroad, Changuinola Valley, Dunlap 392.

6. LEPIDIUM L.

LEPIDIUM L. Sp. Pl. 643. 1753; C. L. Hitchcock in Madroño 3:265–320. 1936; ibid. 8:118–143; Lilloa 11:75–134. 1945.

Annual or perennial herbs, glabrous or pubescent with simple trichomes; leaves entire to bi- or tripinnate, sessile or the lower petiolate; inflorescences terminating the upper branches, racemose, congested in flower, elongating in fruit; flowers small; petals lacking or mere vestiges or up to 3 mm. long, white to sulphur-yellow; stamens 2, 4 or 6, anthers nearly orbicular; siliques strongly flattened contrary to the narrow replum, usually rounded, glabrous to hirsute, apex scarcely

notched and barely winged to deeply notched and prominently winged; styles present or absent; seeds 2, one in each locule; cotyledons accumbent to incumbent.

1. *LEPIDIUM VIRGINICUM* L. Sp. Pl. 645. 1753.

Annual; stems freely branched, 1.5–6 dm. high, sparsely pubescent above with minute trichomes; lower leaves irregularly toothed to pinnately divided; upper leaves oblanceolate, acute, irregularly toothed or serrate to almost entire, cuneate at base, becoming smaller upward; racemes numerous and many-flowered; sepals glabrous to sparsely pubescent, ca. 1 mm. long; petals white, slightly exceeding the sepals; stamens usually 2; fruiting pedicels terete, divaricately ascending to spreading at right angles, glabrous or nearly so, somewhat longer than the fruits; siliques glabrous, orbicular to slightly longer than broad, 2.5–3.5 mm. long, shallowly notched at apex; style included in the shallow notch; seeds wingless; cotyledons accumbent.

Typical *Lepidium virginicum* is native to southeastern North America and the West Indies. The species as a whole has many varieties and is widespread in North America and is found in parts of South America. As a weed, it is even more widely distributed. The following collection belongs to var. *typica*.

CHIRIQUÍ: pasture weed around Alto Lino, vicinity of El Boquete, Maurice 712.
